BBVA Case Study: The effect of financial performance on shareholders wealth before and after Fintech acquisition

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ABSTRACT

The objective of this Final Degree Project is to analyze whether Fintech acquisitions have improved BBVA's performance, solvency, and liquidity, and then study the relationship between the increase in performance variables with the shareholder value variables comparing the pre-acquisition period and the post-acquisition period with linear regression analysis. First, the acquisition process and the contribution that each Fintech has made at BBVA have been studied. Subsequently, a comparative graphical analysis of the post-acquisition period was carried out to analyze whether the acquisition of the four Fintech companies has increased performance, liquidity, solvency, the efficiency of assets and value for BBVA shareholders. Of these nine variables, those corresponding to performance (ROE, ROA, and EPS) and shareholder value (share price and PER) were selected to carry out linear regression analysis to study their correlation in two different periods.

To carry out this study, the annual reports have been consulted to obtain the value of the financial ratios; and shareholder value data has been collected from a research platform called Macrotrend

KEYWORDS: Fintech, BBVA, performance, shareholder wealth, digital transformation

RESUMEN

El objetivo de este Proyecto Final de Grado es analizar si las adquisiciones de Fintech han mejorado el rendimiento, la solvencia y la liquidez de BBVA, y luego estudiar la relación entre las variables de rendimiento con las variables de valor para el accionista comparando el período previo a la adquisición y el posterior a la adquisición período con un análisis de regresión lineal. Primero, se ha estudiado el proceso de adquisición y la contribución que cada Fintech ha hecho en BBVA. Posteriormente, se realizó un análisis gráfico comparativo del período posterior a la adquisición para analizar si la adquisición de las cuatro empresas Fintech ha aumentado el rendimiento, la liquidez, la solvencia, la eficiencia de los activos y el valor para los accionistas de BBVA. De estas nueve variables, las correspondientes al rendimiento (ROE, ROA y EPS) y el valor del accionista (precio de la acción y PER) se seleccionaron para llevar a cabo un análisis de regresión lineal para estudiar su correlación en dos períodos diferentes.

Para llevar a cabo este estudio, se han consultado los informes anuales para obtener el valor de los ratios financieros; y los datos del valor para los accionistas se han recopilado de una plataforma de investigación llamada Macrotrend

PALABRAS CLAVE: Fintech, BBVA, rendimiento, riqueza de los accionistas, transformación digital.

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I. INTRODUCTION

The objective of this TFG is to analyze BBVA's Fintech acquisitions between 2013 and 2016. The choice of this topic is due to the disruptive potential of startups in the banking sector, which due to the technological revolution, have become the main competitor of the large and traditional banks, which scared of losing market share, have adapted their distribution channels, adjusted their business model to new customer demands or even acquire some of those startups.

Due to the potential of startups and the importance of the banking system in our economy, it is interesting to analyze the case study of BBVA, a leading Spanish bank in Fintech incorporations and one of the first to adapt to technological trends in the banking sector.

This study specifically focuses on whether the purchase of Simple, a British online bank, Madivas Solution, a big data startup; Spring Studio, a design startup, Holvi and the purchase of the stake in online bank Atom Bank were a good investment for performance, liquidity, solvency, asset efficiency of BBVA.

Furthermore, it will be analyzed whether, after the acquisitions, the relationship between the increase in performance and the value of the shareholders has increased compared to the pre-acquisition period.

Not only will the acquisition strategy be analyzed from a financial and economic point of view, but also its importance in BBVA's growth.

As for the structure of this TFG, it is divided into three sections, the theoretical framework, where the banking sector and Fintech will be studied, followed by the specific BBVA case study and ending with the comparative and regression analysis.

As for the theoretical framework, it has three sections: the introduction of traditional banking, its elements and characteristics; the Fintech sector, where it remark their value proposition and key tools, and finally the analysis of the Fintech sector from a global and Spain market point of view.

In the case study section it explains the BBVA digital transformation strategy highlighting the open innovation and a detailed study of the Fintech acquired during these 6 years.

Regarding the analysis, we will divide our general objective into two specific ones: the analysis of the ratios for the study of whether BBVA has increased its performance, liquidity, solvency, asset efficiency after the purchase of the Fintech companies; and a pre-acquisition and post-acquisition regression analysis to study whether the increase in performance has more influence on the value of the shareholders before or after the acquisitions.

Performance variables have been selected because one of the objectives of acquiring these startups is to create more valuable assets for BBVA.

The selection of the shareholder value variables is because the main objective of a company is to create value for its shareholders, therefore, it has been studied the relationship between BBVA's performance and shareholder value.

Data collection has been carried out through BBVA's annual reports, the Spanish banking association, and data from the macrotrend platform.

Finally, all the conclusions will be summarized in the last section with some recommendations and ideas for further studies.

II. THEORETICAL FRAMEWORK

2.1 Traditional banking

2.1.1 Definitition and characteristics

« The Financial System was born as a response to the demand for money with productive purposes with institutional support » (El Monte, 2003).

> The financial system is made up of institutions, media, and markets to capture the surplus from savers and offer it to public or private borrowers. Furthermore, the financial system includes both financial instruments or assets, as well as financial institutions or intermediaries and financial markets (Rodríguez et al., 2008)

> As Antonio Calvo (2012) indicates, every financial system has two essential functions. Firstly, to ensure effective allocation of financial resources and secondly, contribute to monetary and financial stability. The best way to achieve these two objectives is to follow the rules of the market, that is, to make it a free and transparent system.

2.1.2 Elements of the financial system

The Financial System is formed by the assets that are loaned, the intermediaries, and the market that puts them in contact. Next, we will explain each of them in greater detail:

- Financial Assets

> As described by Rodríguez and Parejo (2011), assets or financial instruments are the titles issued by the economic spending units, which are a means of maintaining wealth for those who own it and liability for those who generate it. There are real assets and financial assets. Real or physical assets create wealth and financial assets as they are liabilities they do not contribute to increasing wealth.

- Financial intermediaries

> «Financial intermediaries are the set of institutions specialized in the mediation between lenders and borrowers to reduce costs in obtaining financing and facilitate the transformation of some assets into others (Rodríguez et al., 2008). »

> According to the European Central Bank's monthly bulletin (ECB, 2012), financial intermediaries transform short-term assets (desired by lenders) into long-term assets (desired by borrowers) with lower prices due to economies of scale. Besides, the financial intermediary facilitates the exchange and payment of goods and services between agents.

> «Agents are in charge of advising and advising for what they charge commissions. There are three types of agents; brokers, who act on their own by charging a commission. Dealers, who unlike the former, can act on their own, and Market-Makers (El Monte, 2003). »

- Financial market

> A financial market is a physical or online place where financial transactions are carried out. The functions performed in financial markets, according to Rodríguez (2008) are to facilitate contact between buyers and sellers of financial assets and determine the price of assets.

2.1.3 Structure of the spanish financial system

There are 3 general areas in the financial system; the credit area, the insurance and forecast area, and the securities area.

1. The Credit Area, headed by the Bank of Spain regulates the financial assets.
2. The Insurance and Social Security Area, headed by the General Directorate of Insurance, which includes everything related to the insurance activity.
3. The Securities Area, headed by the National Securities Market Commission, which regulates and controls everything related to the securities markets.

2.1.4 Online and electronic banking

Traditional banks have realized the need to adapt to the digital transformation if they do not want to lose their most valuable activities and only pursue low-margin activities such as accounts or transactions. Due to this fact, they began their digitization with the creation of electronic banking to improve the experience for their clients, which consists of the provision of financial services by computer means in real-time. Besides, financial institutions offer online platforms or apps to access their financial products through mobile ATMs or interactive television. The main characteristics of electronic banking are the ease of registering, notifications of your operations, and the highest level of customization.
Unlike electronic banking, online banking offers its services on the Internet through telephone, mail, or mobile, which operate 24 hours a day, every day of the year, and at lower costs (Momparler, 2008).
According to a study carried out by CB Insights, the main challenges of the digital transformation for banks are the integration of traditional systems with new technologies (59%), security and privacy (57%) and the lack of experience and knowledge within the organization itself (51%).

2.2 Fintech

2.2.1 Definition

The FinTech term comes from the integration of "finance" and "technology." Those are non-financial companies that use digital technology and tools from the fourth industrial revolution such as cloud computing, blockchain, big data, artificial intelligence to provide financial services in innovative ways. Usually, banks integrate them horizontally and vertically in their value chain.

2.2.2 Types

- New ventures (startups) and usually young companies with less than 10 years in the market. They specialize in niches within the value chain of banks.

- Giants of technology or e-commerce such as Amazon, Samsung, and Alibaba. This group integrates financial services into its business model of retail or telephony. These types of companies are already active in fintech but have not entered the market decisively. However, its great potential is due to wide access to large amounts of customer information and data.

2.2.3 Value proposal

The potential of FinTechs is due to their competitive characteristics and value proposition as they offer a greater customer experience through the simplification of technology and processes available anytime, anywhere. These startups leverage technology to improve the operational inefficiencies of traditional institutions and improve the customer experience. Thanks to the lower-cost data generation, aggregation, and analysis, Fintech can adapt easily to changes than traditional banks. These new models of banking services have been able to reach population groups that were not usually targeted by traditional banks, such as microenterprises

2.2.4 Key tools of the fintech sector

Fintech companies offer innovative solutions with their advanced technology and act as intermediations in financial service delivery.
The most used tools for Fintechs are the cloud solution, improved processes, smart and faster machines such as blockchain, machine learning, and artificial intelligence.
According to John McCarthy, artificial intelligence is a science that uses ingenuity to process data and produce intelligent computer programs and machine learning derives from Artificial Intelligence as it is based on experience to perform a certain task better and better. The main objective is to use facts and evidence to be able to create hypotheses and to be able to make future predictions (Mitchell, 1997).
By using the Artificial Intelligence of FinTech it can reduce the number of humans needed for less valuable work so that they can focus on work with higher added value. Moreover, machine learning offers the opportunity to improve the customer experience. (Kotarba, 2016).

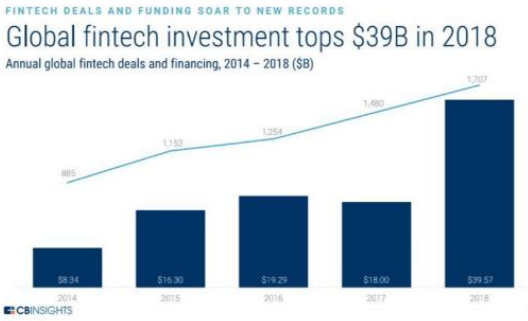
Fintech offers various branches of financial services, including individual and business financing, fund transfer, financial and investment advice, payments and collections via Smartphone and mobile devices, investment control, and personal finance.
Although Fintech companies offer a full range of services, according to the report "Beyond FinTech: A Pragmatic Assessment", done by the World Economic Forum in collaboration with Deloitte, Fintech companies will not replace banks.
The main reasons are that switching costs are high and the technological innovations of these Fintech companies are not yet attractive enough for customers to change companies. Besides, the security offered by a large bank and its high levels of solvency make clients feel more comfortable when contracting service in a traditional bank and not in a small startup.
The added value of Fintech companies is that banks have always been more focused on the products they offer, unlike startups that focus more on customers and their experience. These Fintech companies offer a better customer service thanks to their tools such as Big data or machine learning, so the customer profile they attract is usually a young customer who is used to use these technological innovations, which saves them a lot of time and effort, and value this innovative service that these Fintech offer.
However, thanks to the entry of these startups in the market, user experience standards have increased, so traditional banks have had to improve their customer experience in order not to lose market share. Thanks to the rapid growth of fintech companies, it has allowed banks to outsource parts of their innovation processes since they generally prefer to wait to see how the client behaves towards innovations before investing and developing their own, which makes cooperation between banks and startups an attractive idea for both parties.

2.3. Fintech sector data

2.3.1 Global data

The most used tool for Fintech to finance their projects are risk capital. According to the CB Insights report, startups managed to get 39,570 million dollars (about 35,000 million euros) through venture capital in just 2018, 120% more than the previous year. Investment in the FinTech sector has grown exponentially since 2013, reaching $ 19 trillion in 2015. As shown in graph 1, in 2017, the total investment was 1,480 operations and in 2018 this number increased to 1,707 operations reaching 24.880 million dollars.
The reason behind this growth is the 52 mega-rounds done this year. A mega-round can be defined as an operation that exceeds $ 100 million.

Figure 1: Global Fintech Investment



Source: CB Insights 2019

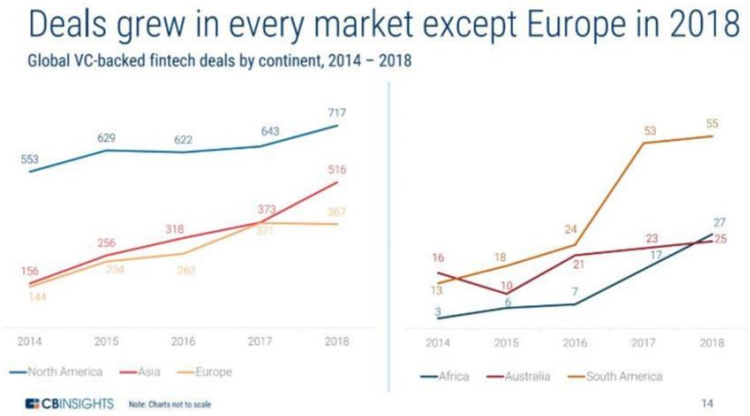
The second graph shows the Fintech financing backed by risk capital at the international level by continents. As can be seen, North America no longer drives the growth of financing of Fintech startups globally.

Figure 2: North America fintech Investment

Source: CB Insights 2019

The following graph, shows how Europe has been the only one that has not grown compared to previous years, however, it reached 3,530 million dollars but no growth compared to the previous year.

Figure 3: Fintech Investment in Europe



Source: CB Insights 2019

2.3.2 Spanish data

According to the Finnovista "Fintech radar for Spain" report, the Spanish Fintech sector has increased by 16% in the last year, reaching 392 companies at the end of October 2019. The highest concentration of startups is located in Madrid with an activity of 51%, followed by Barcelona with 12% and Valencia with 10%, according to the study "Finnovista Pitch Day Madrid". Also, they concluded than more than 70% of the Spanish startups have received funds and 67% are in the process of seeking financing. A total of 32% have raised more than 100,000 euros.

Another report from the FinTech Observatory of Finnovating 2018 concluded that startups are planning to offer 4,500 new jobs in the next year. According to the same study, more than 90% of European and Latin American startups consider Spain a bridge that connects both markets. According to Latin American entrepreneurs, Spain has placed fourth place as a more pleasant country for startups, only behind the UK, USA, and Germany. Regarding the collaborations between Fintech and traditional companies, 75% of the 300 Spanish startups collaborate with a traditional company and 50% of financial institutions have agreements with these Fintech companies. The most useful technologies for the sector CEO are Blockchain, Big Data Analytics, Artificial Intelligence, and Machine Learning.

According to the annual report named Map of Entrepreneurship prepared by Spain Startup South Summit in 2019, claims that 23% of startups are in the Growth phase and 34% in the early stage phase. Furthermore, according to the study, 49% of startups generate income and 17.1% have positive EBITDA. 51% of startups have financed themselves.

2.4 Partners or competitors

As seen in the previous images, Fintech companies have become a great competitor to traditional banks, and many are wondering if they will ever replace banks and change the whole banking industry.

FinTechs offer the same services as traditional financial institutions but more efficiently thanks to their technological innovation.

It should be noted that many of the Fintechs need banks for their activities. For example, the payment systems offered by a Fintech often require a previously existing bank account in a traditional bank, so they depend on each other.

Although with this collaboration the banks lose part of their margins, they continue to maintain their clients and can offer them a wide range of services based on Big data thanks to the technological innovation offered by Fintech companies.

Another interesting point to mention is that banks are highly regulated and this makes their processes longer and more complex, so once legal institutions begin to regulate Fintech companies, they may lose their value of flexibility and speed in processes and their only left value-added will be the technological innovation, which banks can also obtain by hiring highly-skilled IT professionals. However, in some industries, simply owning these digital innovations has distributive the entire sector, a clear example would be Uber.

In conclusion, those traditional banks that will follow up a digitalization strategy thought to collaborate with Fintech or adapting the innovations in their systems will have no issues in staying in the market, and only those that will not adapt to new technologies will end up leaving the market due to inefficiency.

2.5 RegTech

Another type of companies that also uses technological innovations as Fintech do are Regtech, which were born in response to the new online financial services. The term RegTech refers to technology companies that facilitate regulatory compliance more efficiently and effectively. These companies use technologies such as blockchain, cloud, big data, biometrics or artificial intelligence to optimize the processes of financial companies.
Regtech use elements such as biometric security systems when large amounts of data are used (Big Data), information protection and monitoring protocols (Blockchain), and increasing use of Artificial Intelligence.
Its main objective is to enforce regulatory requirements in the easiest and most efficient way possible.
RegTech offers technological solutions for the prevention of money laundering and terrorist financing, consumer protection, risk mitigation, data protection or fraud prevention. These companies help ensure the security that all financial operations are in accordance with current legislation.

Not only do they offer technology solutions, but they also help optimize bank efficiency, reduce risk, and improve customer experience. Banks are also interested in these solutions because one of their most important fixed costs is everything related to compliance with laws, especially after the 2008 global economic crisis, where regulations for the financial services industry started to be stricter to avoid a new economic crisis.

The RegTech ecosystem in Spain continues to grow and it is expected higher growth in the next years. According to the report produced by Spanishfintech, in February 2018 in Spain, there are 82 companies related to risks, big data, identification, or cybersecurity.

2.6 Previous studies

This study analyzes if the studied variables of performance, solvency, liquidity, and asset structure have improved after Fintech acquisitions and if there is a relationship between

market value variables such as stock price and price-to-earnings ratio and the variables of performance like ROE, ROA, EPS.

According to the study carried out by N. Kiilu entitled "the effect of Fintech firms on the financial performance of the banking sector", it was found a positive relationship between the acquisition or cooperation between banks and Fintech and the increase in performance by the bank.

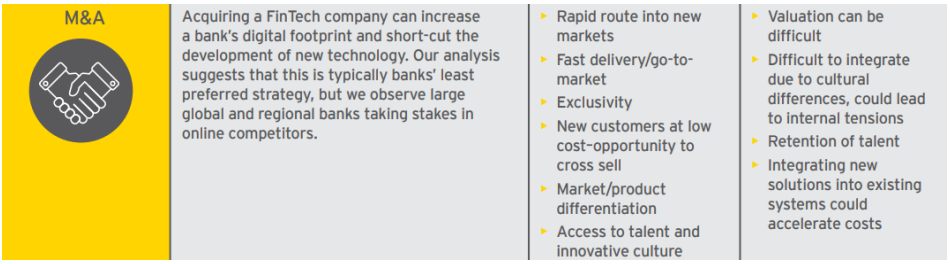
Previous studies carried out by J.Hall and Mohamad Rianto conclude that there is a positive correlation between both variables. According to J.Hall and his study on “the relationship between the market value of a company and internal performance measurements” concludes that there is a slightly lower positive correlation between market value and traditional accounting-based corporate performance measures such as ROA, ROE, EPS, and Dividend per share DPS.

In Mr. Rianto's study on “The effect of earnings per share and ROE on the stock price of banking”, a positive correlation was also found between Earning per share and Return on Equity on Stock Price. His conclusions were that investors want to invest, they look first at the financial performance that can be measured through the financial ratios, Earnings per Share (EPS), and Return on Equity (ROE).

This case study will analyze whether there is also a positive correlation between market price and performance variables, but specifically in the case of BBVA. In addition, two periods, pre-acquisition and post-acquisition, are compared to see how the effect of the ROE, ROA, EPS ratios on the stock price and PER has changed.

Another interesting study to highlight from the Fintech acquisition point of view is EY's “Unleashing the potential of FinTech in banking” where 45 major global banks and their interaction with Fintechs were analyzed. As can be seen in the following table, although the acquisition is not one of the first options of the banks, it can lead to many benefits for them.

Figure 4: Advantages and disadvantges of M&A



Source: EY

The conclusion of the study is that acquisitions are due to the digital transformation strategy that traditional banks are carrying out in recent years where technology has broken into all sectors and banking is no exception.

III. CASE STUDY: BBVA

3.1 History

BBVA is a financial institution created in 1857 in Bilbao by the Board of Trade with origins as an industrial bank. In its beginnings, it was a bank that issued banknotes until 1878 when it became a bank for loans and discounts. At the begging of 1902, it started with growth strategies via company integration when he merged with Banco del Comercio. Later, in 1988 Banco Bilbao merged with Banco Vizcaya forming Banco Bilbao Vizcaya (BBV), and in 1999 BBV merged with Argentaria, a group of recently privatized Spanish public domain banking entities. After this merger, it began its international expansion in Latin America with the acquisition of Banco Continental de Perú (1995), followed by Banco Francés de Río de Plata in Argentina (1996), ending Banco Excel Economico S.A de Brasil (1998).

One of its most important acquisitions was in 2007 when it acquired a stake of 458 million euros in the China National Citic Bank.

This study will analyze 5 acquisitions made between 2014 and 2016, which were acquired with a different objective than previous acquisitions and mergers. The latest acquisitions were aimed at modernizing and helping the bank's digital transformation, unlike previous ones that simply aimed at gaining market share, growth, and international expansion, especially in Latin America markets. Being in the technology age with technological advances such as AI, blockchain, and big data, it is interesting to analyze how the acquisitions of the Fintech companies, leaders in technological fields, have led to an improvement in the BBVA system.

3.2 Digital transformation

BBVA began its digital transformation in 2006 when it started investing to modernize its systems and automate its transactions. In the beginning, its strategy focused mainly on data mining and the construction of intelligent algorithms.

Between 2006 and 2013, during the financial crisis, BBVA invested an average of 700 million euros per year.

But it was not until 2013 when it implemented a new model, Banco Fácil, where clients have self-service spaces and specialized advice. It also opened automated offices that were available 24 hours a day, equipped with an ATM called ABIL, that replicates the experience of using tablets and offers the additional possibility of receiving remote help from a BBVA agent. Currently, BBVA is working with Google Cloud to maximize the efficiency and flexibility of his processes.

3.3 Digital banking

As BBVA was one of the first ones to adapt to this new digital banking services it has a significant number of digital clients and especially in the mobile sector, beating Grupo Santander, LLoyds and Barclays. The reason behind its success in the mobile sector is due to its two main products, BBVA-Wallet and Wibe. On one hand, Wibe is used to purchase car insurance and uses artificial intelligence to advise users on how to better negotiate when they want to sell their vehicles. On another hand, The BBVA Wallet is a mobile payment

application that seeks to replace the use of credit cards and cash to make physical or online purchases.

3.4 Strategy

BBVA's main strategy is to acquire Fintech startups that help the bank modernize its services and implement open innovation programs, a tool used to enter new markets within the existing markets using new technologies to accelerate their innovation and prepare to the digital age. .

3.4.1 Open innovation

One of the main pillars of BBVA's digital transformation strategy has been Open Innovation. Open Innovation (AI) is a tool that has allowed the BBVA to identify disruptive solutions and technologies and collaborate with Fintech entrepreneurs and startups.

3.4.1.1 Open innovation drivers

BBVA's current open innovation system consists of 4 innovation drivers represented in graph 4. The first resource is risk capital, followed by competencies and incubators both through external resources, internal incubators that come from internal resources and finally collaborations between other companies.

Figure 5: BBVA's Innovation drivers

Source: BBVA 2019

3.4.1.1.1 Venture capital

Nowadays, Venture capital is essential for startups that look for financing. According to Accenture, at least half of the top 100 companies on the Fortune 500 list and 17% of the rest of the 400 on the list have a venture capital fund. BBVA started in 2011 by investing in a third-party venture capital fund but it was not until 2013 it created its investment vehicle, BBVA Ventures. At the beginning of 2016, it created an independent company, Propel, to attract more entrepreneurs, in addition to overcoming the limitations that, by law, banks in the United States have to invest in related companies (BBVA Press Release, 2016).

As was explained previously, at the beginning BBVA's investment and acquisition were focused on the United States, and in the last years, it spread to Europe and Latin America.

3.4.1.1.2 Skills and accelerators

3.4.1.1.2.1 Skills

His second project was the creation of competitions such as the Open Talent or Innova Challenge to promote innovation. The Open Talent is a contest created in 2009 by BBVA to identify and help young companies to make their projects possible with the support of the bank. 23 winning companies have emerged from this contest, who have won prizes of € 910,000 and have received € 116 million in additional financing.

3.4.1.1.2.2 Accelerators

After winning the competition, startups can access to the bank's internal and external resources to finish developing their projects.

3.4.1.1.3 Internal incubators

Another objective of BBVA is to promote innovation from inside through the creation of independent companies or in collaboration with its employees.
An example of an independent company created to innovate is BBVA Data & Analytics (B&D), a financial information analysis center created in 2014 to analyze big data.
An example of collaboration is the BBVA Beta Testers, a website where staff can test applications.

3.4.1.1.4 Collaboration and joint creation

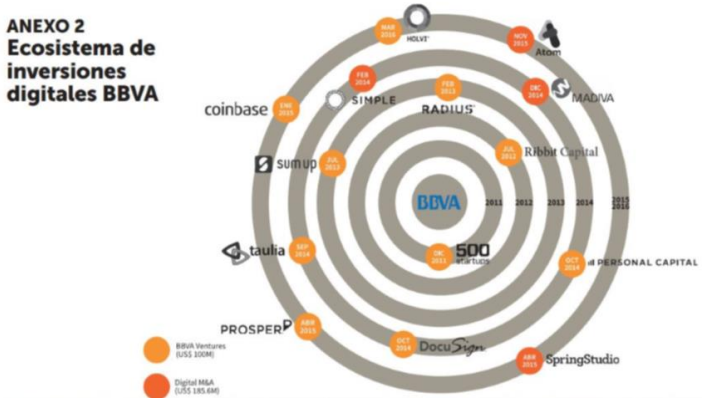
3.4.1.1.4 Joint APIs

An application program interface (APIs) is a set of protocols and routines that allow communication between companies or between companies and individuals. Currently, the best technological solution to open bank details is an API.

3.4.1.1.4 Collaboration

One of his best strategies was the alliance with Ondesk, which uses technology to help to provide financing to small and medium-sized companies through traditional banking channels.
In return, BBVA will use the OnDeck methodology to provide the service to customers with loans of up to $ 250,000 and the possibility of disbursing financing in just one business day.

Figure 6: BBVA's ecosystem of digital investment



Source: BBVA 2019

In the previous image, you can see all the acquisitions and investments that BBVA has made to accelerate its digital transformation.

3.5 Digital investment and acquisitions

BBVA was one of the first financial institutions to realize the potential of FinTech startups in the financial sector, so through its venture capital known as Propel, it made its first acquisition in 2014. Propel venture partners (BBVA ventures) is an independent venture capital firm created in 2012 in charge of searching for new business opportunities. Propel has invested in companies such as Personal Capital, Taulia, DocuSign, SumUp and the Ribbit Capital venture capital funds and 500 Startups.
BBVA's objective is to search for fintech startups that exceed the average profitability of the sector, which is 20%, and that complements its strategy and vision to accelerate its digital transformation of the bank.
The bank's first acquisition was Simple, a digital bank for American banking services in February 2014. The second was in December of that same year when BBVA acquired Madiva Soluciones, a Spanish data analysis startup that is behind many of its best projects such as BBVA Valora. The next year it acquired Spring Studio, a leading American design, and user experience startup and made an bought a stake of 39% in the Atom Bank, the first bank created exclusively for mobile devices in the United Kingdom, without bank branches. Finally, in 2016 acquired Holvi, a Finnish neobank specialized in means of payments for microenterprises.
The two most recent investments were in 2018. In October of that year, BBVA signed an alliance with Anthemis Group to create a laboratory for fintech startups in London, to promote the creation of new financial startups; and in March 2018, it also made a minority investment in the German 'startup' solarisBank, one of the first digital financial services platforms with a bank card, which has developed the concept of 'banking as a service' through the use of APIs. However, these investments will not be studied due to the short period between the alliance.

3.5.1 Simple

BBVA's first acquisition was Simple in February 2014, a mobile digital banking startup in the United States for $ 117 million (current € 104 million). BBVA paid $ 98 million in cash and promised to pay another 13 million based on objectives and 3.5 million in 2019.
Simple was founded in 2009 as a retail bank for online and mobile operations to help its customers to control their finances through algorithms. After the acquisition, Simple has had access to BBVA's resources for its expansion and announced a 330% growth in its financial services, compared to the previous fiscal year. However, the first year after the purchase it had losses of $ 11 million and from 2014 to 2018, the company accumulated losses of $ 207 million, so a first adjustment was made to the valuation of $ 12.5 million and in the following two years, BBVA made two other adjustments to the valuation of the assets: one of 17 million and another of almost 60. Simple touched ground in 2016, due to the valuation adjustment, after suffering losses of 92 million. According to the founders, these losses are due to focusing more on infrastructure projects and not on their clients. One of the problems that most affected its clients was the migration of accounts from its initial provider bank, The Bancorp Bank, to BBVA. These problems also led to a change in the directive of the CEO

and co-founder, Joshua Reich, for David Hijirida, director of Amazon in May 2018. Besides, the workforce was reduced by 10% during the summer of 2017.
Even though in the first quarter of 2018 Simple exceeds the expectations for revenue, gross margin and net profitability, it stills accumulates 207 million dollars (184 million euros) of losses in 2019. However, BBVA confirmed that it will keep Simple alive.
Today, Simple becomes a leader in US savings accounts. with an interest rate of 2.02%, the best available for customers in the country.

3.5.2 Madiva solutions

The second acquisition was Madiva Soluciones, a startup specialized in big data and cloud computing, which was acquired by BBVA in 2014, through BBVA Ventures, its venture capital fund.
Like Simple, Madiva also acts independently of BBVA and many of the bank's most popular applications have come out of it, among which BBVA Valora, Bconomy and BBVA Invest stand out. Valora is a tool capable of calculating the market value of a flat through big data. Bconomy is a tool to organize and control the domestic economy, savings plans and budgets. BBVA invest helps the user to find their best investment option.
He has also contributed to BBVA Data & Analytics projects, contributing new algorithms.

3.5.3 Spring Studio

In 2015, BBVA acquired the startup Spring Studio, through its US subsidiary, Compass Bank. Spring Studio is a Californian design company founded in 2001 that operates as an independent company but focused on BBVA projects. The startup has also collaborated with the creation of a money transfer platform between the United States and Mexico and with the creation of a Chatbot.
Through this acquisition, BBVA wants to improve the digital consumer experience by improving the design with Spring Studio. BBVA's objective with the acquisition of Spring studio is to develop models called ‘atomic design’, which allow products to be launched on the market much faster.
These models cover the most basic aspects of design, such as colors and fonts, even more, complex aspects.

3.5.4 Atom bank

In November 2015, BBVA invested around 64 million euros in Atom in exchange for the 29.5% stake, and in March 2018 BBVA increased its stake to 40% of the shares.
In 2018 and according to BBVA accounts, BBVA paid 99 million euros for taking an extra 9.16% of the shares and reaching 39.06% of the total. The complete investment in the company reached 197 million euros. Although Atom Bank grows fast it still generates losses, since 2016, Atom accumulates net losses of 138 million euros.
Atom's mission is to create a mobile bank that specializes in its clients and that offers the best experience. It was also the first mobile bank to obtain a banking license.
BBVA is a key partner that has participated in several rounds of financing. Even in April 2019, BBVA considered the purchase of 100% of Atom due to fear of the loss of veto or the preferential right of purchase on the securities. Another option was the IPO, but that was complicated given its bad first quarter of 2018.

3.5.5 Holvi

In 2016 BBVA acquired the Finnish startup that offers banking services to SMEs in Germany, Austria, and Finland. In 2018, Holvi already had a client portfolio of more than 150,000 micro-businesses in Europe and with the growth of more than 60% between 2017 and 2018. Holvi specializes in design services for all types of customer profiles and thanks to the acquisition of Holvi, BBVA has improved services for micro-companies, facilitating the management of expenses and data. Holvi's objective is expansion throughout Europe, specifically Ireland, Italy, Belgium, France, and the Netherlands with the financial support of BBVA. Currently, it has more clients outside than within Finland and had become a leader in banking services for microenterprises in the EU.

3.6 Fintech acquisition process

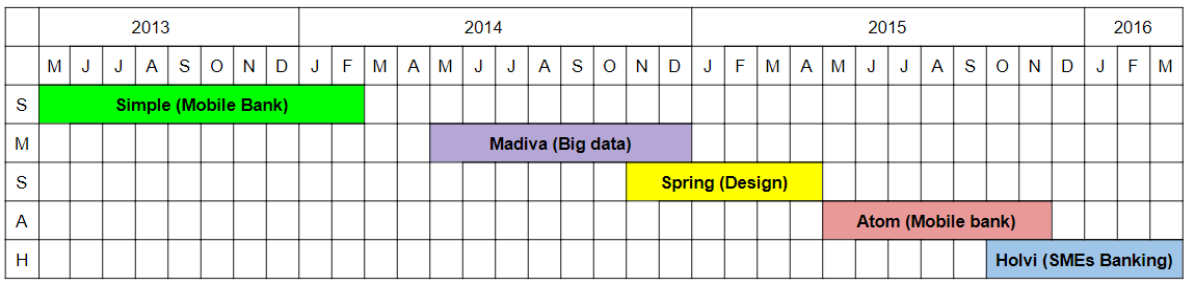
The first step in all acquisitions was to carry out a valuation analysis by BBVA with financial data from Fintech to establish whether these pass the criteria required by the bank. The valuation analysis is not only useful to know if a purchase is profitable but also to be able to offer a reasonable offer.
Next, BBVA launched its purchase offer, and negotiations began. In all cases of acquisition, BBVA made it clear that the Fintech companies would be companies independent of the bank but that they would collaborate on joint projects. This initiative offers freedom and flexibility to startups by making their owners see the acquisition as a collaboration with the bank and are not so reluctant to sell.

The next phase is known as M&A due diligence, a more exhaustive process that begins when the offer has been accepted. The purpose of this phase is to confirm the Fintech value calculated by BBVA. This is done through a detailed analysis of every aspect of the business from its customers to its employees.
BBVA focused on those Fintech companies that could contribute to the bank's digital transformation. Simple and Atom bank have enabled BBVA to reach a growing market, mobile banking. Madiva is behind the success of new services with Big data from the bank such as BBVA Valora or Bconomy. Spring Studio improved the customer experience thanks to its designs and finally, Holvi has allowed BBVA to reach a new market segment, SMEs.

Finally, a purchase and sale contract was made where it was specified whether it was an asset purchase, such as Simple, Madiva, Spring, and Holvi, or a purchase of shares such as Atom Bank. From here, both companies began to work together.

The acquisition period for each Fintech is different and difficult to estimate due to the lack of information, so a timeline with estimates has been drawn up:

Figure 7: Estimation of Fintech acquisition schedule



Source: Own Source

The estimates have been based on the complexity of each startup, its size, and the service they offer. For example, Simple as it is a mobile bank, a new market segment for BBVA, it has made the acquisition process longer, since it is not a simple extension or complementary startup to the bank such as Spring Studio or Holvi, but a completely new growth opportunity.
Besides, Spring Studio or Holvi are smaller startups and have fewer clients than Simple, so the analyzes were shorter and simpler.

The purchase of Spring Studio closed in February 2014 and it is estimated that negotiations began in March 2013. And for Spring Studio and Holvi, a six-month duration of the entire acquisition process is expected. Spring Studio was purchased by BBVA in April 2015 and Holvi in March 2016.
In the case of Madiva, the process was slightly longer than that of Spring Studio or Holvi, since it is a Big data and computing clouding startup. Making a financial analysis of a design startup or a financial services SME's is much easier than that of a Big data startup because the value of these is often due to their estimates of future applications in the future, where Big Data is essential but difficult to account for. It is estimated that the purchase offer was launched in May 2013, a couple of months after acquiring Simple, when BBVA is in the middle of a digital transformation phase through Fintech acquisitions.
Finally, Atom Bank being a purchase of shares and not assets, the process is shorter. However, being a well-known Fintech and with many digital clients, this lengthened the process. It should be noted that in April 2019, BBVA considered the option to purchase 100% of the shares, something that had no place, and therefore is not reflected in the schedule.

3.7 Fintech contributions

At the end of 2014, BBVA launched a mobile banking application for its clients, just after it acquired Simple and Madiva.
The app was created by the BBVA Next Technologies team who surely collaborated with Madiva, specialists in Big data, and who facilitated the development of the application. Besides, acquiring Simple was also a great help in guiding and advising BBVA developers since Simple has experience in the online mobile banking sector.

However, Madiva's best-known projects are BBVA Valora, Bconomy and BBVA Invest.
Madiva Soluciones, S.L., being a technology company, provides tools and solutions for the analysis of information for new BBVA applications. Through its Madiva technology it generates information from various sources and can create algorithms.
Specifically, the BBVA Valora app offers information to the user who is thinking of buying or buying a home. The app calculates the approximate purchase price and estimates the impact this purchase could have on a customer's finances. The compilation of all this information was carried out by the Madiva team.

Another success of BBVA was Bconomy, an application that, based on the expenses and earnings of each client, performs a personalized diagnosis with Big data and algorithms created by Madiva. The main variables of this algorithm are; monthly savings; economic freedom; the expense that goes to the house and the expenses for loans or deferred payments on card.
Finally, in April 2018, BBVA launched BBVA invest, investment funds advising and contracting application. Through a simple questionnaire, the bank profiles the investor and

recommends one type of investment or another. To carry out this profile, an algorithm that surely was created by Madiva is necessary.
Spring Studio being a Fintech focused on customer experience and design, it is more difficult to find out in which projects to collaborate with BBVA.
Finally, the last acquisition was Holvi, a financial services Fintech for SMEs, which has allowed BBVA to reach a new market segment where it was not very successful. Currently, BBVA has increased the number of its SME's clients and Holvi already operates in five countries.

3.8 Conclusions

The acquisitions of these Fintech companies are part of the bank's digital transformation to adapt to new technological trends in the banking sector. This strategy does not simply seek to improve the bank's profitability, but goes further, and seeks a future investment that will ensure BBVA a place in the future of banking. That is why, although many of them have not yet generated positive EBITDA, the bank continues to be interested in maintaining them because it is not simply seeking profitability but a long-term benefit.

The following table summarizes the contributions made by each Fintech within BBVA projects. With this information, it can be concluded that the main reason for the acquisition of these startups is not simply financial but a digital transformation strategy with expectations for future growth

Table 1: Fintech Summary

	Acquisition date	Type of company	Contribution
Simple	February 2014	Mobile bank	Access to mobile bank market Reach more customers Better customer experience
Madiva	December 2014	Big data and cloud computing	BBVA Valora Bconomy BBVA Invest BBVA Data & Analytics
Spring Studio	Abril 2015	Design	Improve consumer experience Develop 'atomic design' models
Atom Bank	November 2015	Mobile bank	Access to mobile bank market Reach more customers Better customer experience
Holvi	March 2016	SMEs Banking services	Improved services for micro-companies Facilitating the management of expenses and data

Source: Own Source

IV. METHODOLOGY AND DATA

4.1. Research proposal

The objective of this research is the analysis of the relationship between BBVA's performance and the value of the shareholders comparing the pre-acquisition and the post-acquisition period. It has been selected two periods, one before the acquisitions (pre-acquisition period) and the other after the acquisitions (post-acquisition period) to see if the effect of performance variables on shareholder variables have changed between those two periods. The reason for selecting a period of six years is because since the first acquisition that was done in 2014 and 2019, the last annual report we have access to, there are 6 years. Therefore, the pre-acquisition period will also be for six years.
This study will use secondary data for the period from 2008 until 2019 from the BBVA's annual reports and the shareholder value data from a research platform called Macrotrend

4.2. Methodology

Firstly, the banking sector and Fintech have been studied to understand the ecosystem in which BBVA operates, and the BBVA's digital transformation strategy through the acquisitions of the five Fintech companies between 2014 and 2016. To carry out this study, nine variables have been selected to evaluate their evolution during the subsequent years of acquisition through a comparative analysis. From all these variables, the performance variables (ROE, ROA, EPS) have been selected to check if after the acquisitions, the correlation between these variables had increased or decreased with respect to the shareholder variables (stock price and PER). The selection of the performance variables is because the shareholders are first more interested in the benefits that a company can provide them rather than BBVA's asset structure or level of debt. And the selection of the shareholder variables is because, in the end, the primary goal of a firm is to maximize the shareholders' value.
The variables have been obtained through the BBVA annual accounts, the accounts of the Spanish banking association and the data on the value of the shares on the macrotrend platform. And the linear regression analysis had been done through the website page Statistic Kingdom.

4.3. Variables

4.3.1 Performance variables

- Return on Equity (ROE)

  Return on equity (ROE) is defined as net income divided by common equity. ROE is used to identify the shareholders' returns. This also indicates the management's performance. (Brigham and Houston, 2007). The higher the ROE means the surplus funds can be invested to improve business operations without having an additional investment of capital from shareholders (Graham, Zweig and Buffett, 2003).

- Return on Assets (ROA)

  Furthermore, return on assets (ROA) will be used to determine the performance of banks. Return on assets is defined as net income divided by total assets. This ratio is used to measure how much profit the company can generate with each dollar of assets.

The higher ROA indicates the company is performing well. (Brigham and Houston, 2007)

- Earnings per Share (EPS)

  Besides, earnings per share (EPS) indicate how much earnings have been generated per share of stock during the reported period. As a firm's earnings increase, earnings per share look better and the firm releasing more shares increases the number of shares outstanding (Gyimah and Oscar, 2011). Earnings per share can be determined as net income divided by the total number of shares outstanding (Brigham and Houston, 2007).

4.3.2 Liquidity variables

- Non-Performing Loans ratio

  NPL ratio measures the number of nonperforming loans in the total bank's loan portfolio, in another word, it indicates the effectiveness of a bank in receiving repayment on its loans. Their main source of income for banks are loans and when a borrower has not made a regular payment for at least 90 days, then the loan is considered a non-performing loan.

4.3.3 Solvency variable

- Debt to Equity Ratio

  The debt-to-equity ratio is a leverage ratio that shows if the financing of a company comes from debt or equity. The higher the ratio the more financing that comes from debt, in other words, it reflects the ability of shareholder equity to cover debts.

4.3.4 Asset efficiency variable

- Efficiency ratio

  The efficiency ratio measures the ability to turn assets into revenue. It is calculated by dividing the bank’s non-interest expenses by their net income.

4.3.5 Shareholder wealth variables

- Stock price

  The term stock price refers to the current price that a share of stock is trading for on the market

- Market Cap

  Market capitalization is the total value of all the shares of a publicly-traded company. It is calculated by multiplying the current stock price by the number of shares outstanding.

- Price to earnings ratio

  The price-to-earnings ratio (P/E ratio) is the ratio for valuing a company that measures its current share price relative to its per-share earnings (EPS). The price-to-earnings ratio is also sometimes known as the price multiple or the earnings multiple.

4.3.6 Additional variables

- Cost of risk

  The cost of risk compares the total costs (losses, risk control costs, risk financing costs, and administration costs) to business sales, assets and the number of employees.

- Number of ATM

4.4. Hypothesis

Comparative financial analysis
Hp1: In the post-acquisition period variables improved

Linear regression study
Hp2: There is a relationship between stock price and independent variables.
Hp3: There is a relationship between PER and independent variables.

V. RESEARCH RESULTS

5.1 Comparative financial analysis

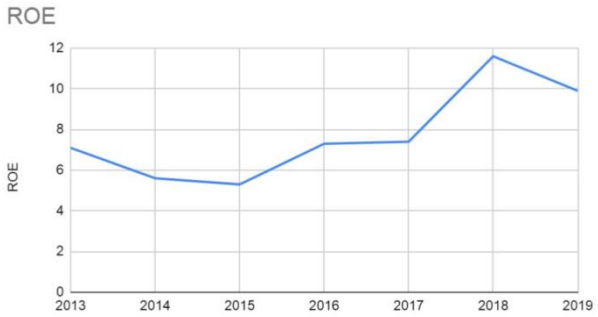
In this section, we will analyze the financial ratios from 2013, one year before the first acquisition, and until 2019 to see if the acquisitions of the Fintech improved performance, liquidity, solvency and shareholder wealth thought a comparative analysis.

5.1.1 Performance analysis

5.1.1.1 Return On Equity

This ratio is important to measures the return for shareholders from the funds invested in the company. Looking at the graph, we can see that BBVA's financial performance fell to 5.3 in 2015 and exceeded 11% in 2018 which means that each euro invested by shareholders BBVA generates € 11.6 of benefits.

Figure 8: Return On Equity



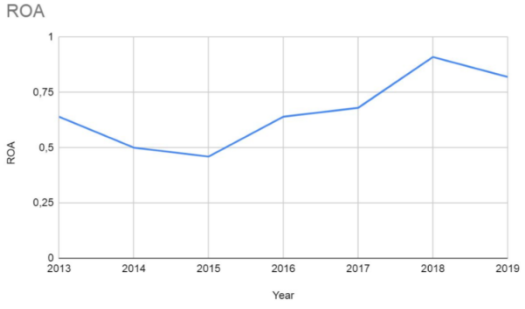
Source: Own source

Comparing to the average ROE of Spanish banks in 2018 which was 8,2, BBVA's return of equity is well above the average which a return of 11,6%. For banks to cover their cost of capital, ROE levels should be closer to 10 % and the average of those 7 years it was 7,74%

5.1.1.2 Return On Assets:

The calculating of ROA measures the financial return of the company and tells us how much profit it can generate from the money or resources required. In the graph, it can be seen that the group's economic profitability increased in recent years and went from a ratio of 0.46% in 2015 to 0.91% in 2018, which means that for every euro invested in BBVA the bank has generated a return of 91%.

Figure 9: Return On Assets



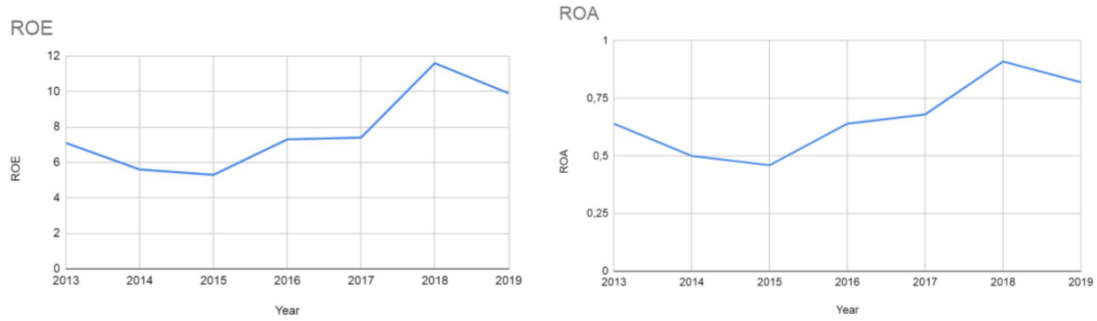
Source: Own source

For banks to cover their cost of capital ROA levels should be closer to 0.8% and the average was 0.66%

5.1.1.3 Relationship between ROA and ROE:

It is interesting to analyze Return on equity (ROE) and return on assets (ROA) together as they are one of the best ways to evaluate how BBVA manages it is resources. Return on equity (ROE) helps investors measure how their investments are generating income, while return on assets (ROA) helps investors measure how management is using its assets or resources to generate more income. Their main difference between them is debt. In the absence of debt ROE and ROA will be equal.
In case the company uses financial leverage and ROE is above ROA. When we take debt, the company invests that extra money in assets and assets increases and consequently equity decreases and increases debt. In other words, when debt increases, equity reduces and ROE increases.
By comparing both graphs we can see that both ratios followed the same trend

Figure 10: Comparison between Return on Equity and Return on Assets

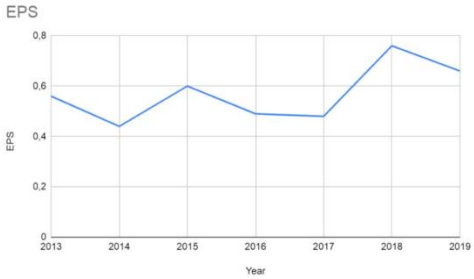


Source: Own source

5.1.1.4 Earnings Per Shares:

EPS is calculated by dividing net profit into the number of outstanding common shares which indicates how much money a company makes for each share. Shareholders will look for companies that offer them high EPS, so the higher the EPS the more attractive it is for investors. We can see that the best year for BBVA's shareholders was 2018 with an EPS of 0,76.

Figure 11: Earnings Per Shares



Source: Own source

Shareholders will look for companies that offer them high EPS, so the higher the EPS the more attractive it is for investors.

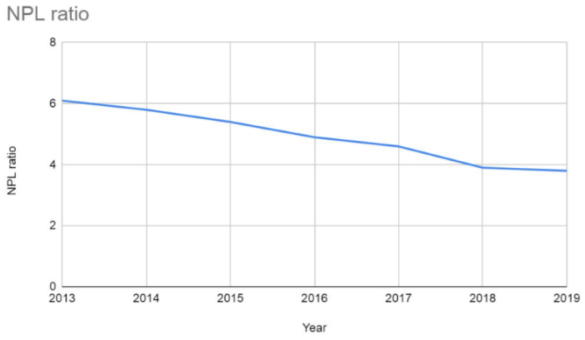
5.1.2 Liquidity analysis

Liquidity ratios are useful to evaluate the firm's ability to pay its short-term debt obligations.

5.1.2.1 Non-Performing Loans ratio:

NPL ratio is used to analyze the quality of the bank's loan portfolios and those in which high NPL ratios can be seen as higher-risk lending. We can see in the graph that BBVA had done a great job by reducing Non-performing loans from 6,1 to 3,8 from 2013 to 2018 which is a good sign of improvement of liquidity.

Figure 12: Non-Performing Loans ratio



Source: Own source

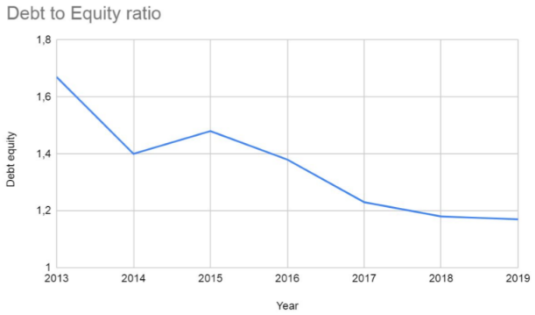
5.1.3 Solvency analysis

Solvency ratios evaluate the ability of a company to pay it's long term obligations. In this part, we will analyze the financial leverage or debt ratios that focus on a firm's ability to meet its long-term debt obligations.

5.1.3.1 Debt to Equity Ratio

The debt-to-equity ratio is a leverage ratio that shows if the financing of a company comes from debt or equity. The higher the ratio the more financing that comes from debt. Banks tend to have higher D/E ratios that go between 1,5 to 2,5, this is because banks carry huge amounts of debt as they have a significant investment in fixed assets in the form of the branch network. A higher leverage ratio is generally good for a bank as it is shown that the bank has higher capital compared to its assets(loans). Banks have fewer creditors than debtors. A higher leverage ratio means the bank has more reserves and also means that it has less money to loan out which reduces its profitability. We can see in the graph the D/E ratio decreased over those years.

Figure 13: Debt to Equity Ratio



Source: Own source

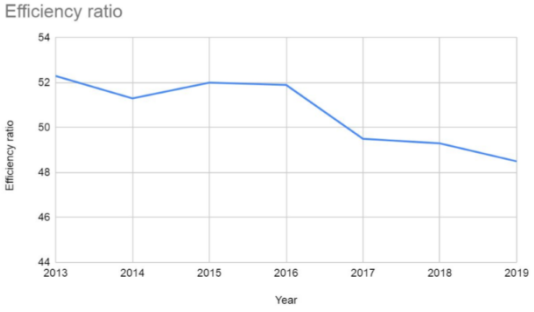
5.1.4 Asset efficiency ratio

Usually, companies measure asset efficiency with asset turnover ratio and current ratio, however, due to the nature of bank business this is complicated as they do not produce physical goods and their main source of income comes borrowing and makes benefits from the spread between the cost of capital and interest income it earns by lending out money to the public. Moreover, banks have a small number of fixed assets, which primarily consist of various fixtures and buildings. Moreover, banks do not organize their balance sheets by current and noncurrent assets and liabilities, as it is impossible to do so.
One clear example deposits, a typical bank's liabilities, which can be withdrawn for clients, so as it is impossible to forecast when a deposit will be demanded, that's useless to classify deposits as either current or noncurrent. However, asset efficiency will be evaluated by the efficiency ratio.

5.1.4.1 Efficiency ratio

The efficiency ratio measures the ability to turn assets into revenue and is calculated by dividing the bank’s non-interest expenses by their net income. An efficiency ratio of 50% or under is considered optimal. If the efficiency ratio increases, it means a bank's expenses are increasing or its revenues are decreasing. During those years, the efficiency ratio has been decreasing and archived a ratio below 50% which is a good sign from a financial perspective.

Figure 14: Efficiency ratio



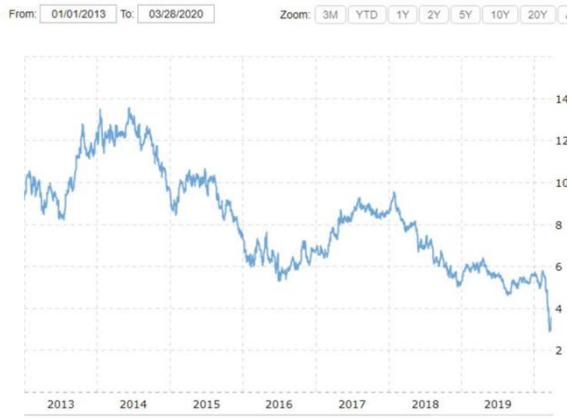
Source: Own source

5.1.5 Shareholder wealth

5.1.5.1 Stock price

The stock price is simply the amount of money it will cost to purchase a share of a company or fund. Stock prices can fluctuate based on many factors. If a company releases a glowing earnings report, then investors will likely feel more optimistic about its potential profitability.

Figure 15: Stock price

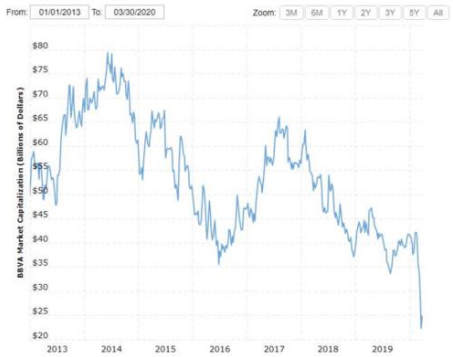


Source: Macrotrend platform

5.1.5.2 Market Cap

Market capitalization is the total value of all the shares of a publicly-traded company. It is calculated by multiplying the current stock price by the number of shares outstanding. The market capitalization of this bank in 2018 increased considerably compared to the previous year, reaching a value of more than 30.9 billion euros.

Figure 16: Market Cap



Source: Macrotrend platform

5.1.5.3 Price to earnings ratio:

The price-earnings ratio (P/E ratio) is calculated as the ratio of the stock market price to earnings per share. A high P/E ratio could mean that a company's stock is overvalued or expecting higher rates in the future. The PER ratio of the financial group in 2018 was lower

compared to the previous year so that in that year fewer years were necessary to recover the investment, given the pace of the company's profit generation

Figure 17: Price to earnings ratio

Source: Own source

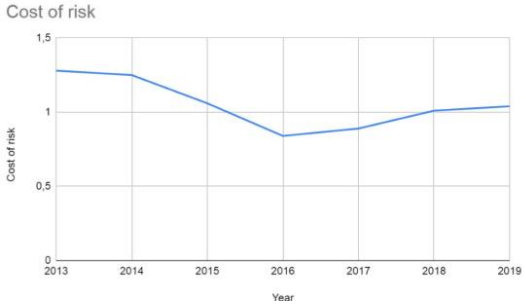
In the case that BBVA hasn't made any profits or is losing money it will feasible to calculate its P/E ratio since the denominator will be equal to 0 so instead it will be necessary to check the P/S ratio to determine whether the stock is undervalued or overvalued. However, as this is not the case, in this project it will not be taken into account the price-to-sales ratio. 5.1.6

5.1.6 Additional ratios

5.1.6.1 Cost of risk

The cost of risk compares the total costs (losses, risk control costs, risk financing costs, and administration costs) to business sales, assets and the number of employees. The purpose of such a measure is to determine if the total costs of risk are increasing, decreasing or remaining constant, as a function of the business's economic activity.

Figure 18: Cost of risk

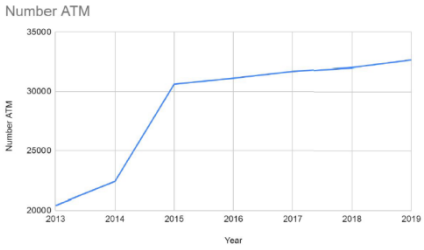


Source: Own source

5.1.6.2 Number of ATM:

It can be seen that BBVA had a total of nearly 6.4 thousand ATMs in Spain as of December 2017. It is also interesting to study the evolution of BBVA's digital clients and online users. BBVA has around 27 million digital clients, 3 million less than the Santander Group.

Figure 19: Number of ATM



Source: Own source

As can be seen in the previous graphs, all the variables analyzed have improved during the post-acquisition period, especially the performance variables. However, it should be noted that the main reason for the BBVA to make these Fintech acquisitions is not to increase their performance, solvency or liquidity, but rather an expansion and growth strategy. These acquisitions are part of BBVA's open innovation strategy that aims to digitally transform the bank and be able to reach its customers with the new channels of the new digital banking sector.
It should be noted that in general the best results were in 2018 just after all the acquisitions were acquired and time of adaptation has passed.

5.2 Regression analysis

5.2.1 Hypothesis

Linear regression study
Hp2: There is a relationship between stock price and independent variables.
Hp3: There is a relationship between PER and independent variables.

5.2.2 Regression model

In this study, it will be analysed the following regression models

Y1 = ß o + ß1X1 + ß2X2 + ß3X3 +error term

- Stock price= ß o + ß1 ROE + ß2 ROA + ß3 EPS+error term
- PER= ß o + ß1 ROE + ß2 ROA + ß3 EPS+error term

5.2.3 Data table

5.2.3.1 Pre-acquisition data table

Table 2: Pre-acquision table

	2008	2009	2010	2011	2012	2013
ROE	21,5	16	15,8	8	4	7,1
ROA	1,04	0,85	0,89	0,61	0,37	0,64
EPS	1,31	1,08	1,17	0,62	0,32	0,56
Stock price	12,29	18,04	10,17	8,57	9,42	12,39

PER	3,34	7,2	4,3	6,69	16,57	18,75

Source: Own source

5.2.3.2 Post-acquisition data table

Table 3: Post-acquisition table

	2008	2009	2010	2011	2012	2013
ROE	5,6	5,3	7,3	7,4	11,6	9,9
ROA	0,5	0,46	0,64	0,68	0,91	0,82
EPS	0,44	0,6	0,49	0,48	0,76	0,66
Stock price	9,39	7,33	6,77	8,5	5,29	5,58
PER	13,95	14,32	10,01	23,18	12,43	10,73

Source: Own source

5.2.2 Results

5.2.2.1. Analysis stock Price of ANOVA

H0 = There is no influence of ROE, ROA and EPs in stock price
H1 = There is an influence of ROE, ROA and EPs in stock price

To study the implication of performance variables in the stock price, a linear regression analysis was carried out through the Statistic Kingdom platform. The results of the analysis indicate that before the acquisition, ROE, ROA, and EPS were important factors that affected 86.3% of the stock price, however, in the post-acquisition period, those variables are no longer significant for the stock price.

Table 4: ANOVA table

	Adjusted R-square	F-test	p-value	Significant
Pre-acquisition period	86,3%	24,09	0.000232761	✓
Post-acquisition period	25,9%	2,28	0.156039	✗

Source: Own source

This study considered that a variable is statistically significant when the corresponding p-value is lower than 0.05.

In the pre-acquisition period, the null hypothesis (H0) that affirms that there is no influence of ROE, ROA and EP on the share price is rejected, in other words, the share price depends on the performance indices, however, in the post-acquisition period we accept the null hypothesis (H0) which says that there is no influence of ROE, ROA and EPS on the share price, which means that the performance variables do not define the stock price.
As seen in the table, the Adjusted R-square of the pre-acquisition study is 86,3%, which means that 86,3% of the stock price can be explained by the variability ROE, ROA and EPS and the rest 13,7% is from others variables not taking into account in this study. Comparing to the post-acquisition Adjusted R-square which is 25,9%, it is clear that after the acquisitions the stock price was determined by other factors. It is important to remark that the stock market sets the price depending on supply and demand as any other market, for instance, if there is a high demand for BBVA's shares due to favorable factors the price would increase. The stock market is really sensitive to many factors so it is complicated to determinate them because sometimes they are based on personal expectations and emotions.
By looking at the F-test and p-value it can be measured the goodness of fit of the model. First of all, we compare the F-test which decreased after the acquisitions from 24,09 to 2,28, meaning that before the acquisitions ROE, ROA, and EPS were significant for the stock price, however, after the acquisitions they are no longer significant. These results also match with the p-value results, which before acquisitions are was 0.000232761 and after it increased to 0.156039 reaching the same conclusion as the F-test.
Looking at table 4, it can be studied if there is an excessive degree of collinearity between the independent performance variables. As can be seen in Table 4, in the pre-acquisition period the variables are not highly related with a value of 1,697, but in the post-acquisition period, the variables are more correlated with a factor of 4,516.

Table 5: Stock price VIF

VIF	
Pre-acquisition	Post-acquisition
1.697	4.516

Source: Own source

It would also be interesting to look at the details of both models to identify which are the variables that are most relevant to determine the stock price. This will help to know exactly which variables (ROE, ROE, EPS) are the most determining factor of the stock price. To analyze this, the specific data of the 3 variables of the pre-acquisition and post-acquisition period have been shown in the following two tables.

Table 6: Pre-acquisition

	Coefficient	SD	T-statistics	P-value	Significant
Constant	10,33	3,38	3,05	0,015	✗
X1	0,09	0,29	0,31	0,76	✗

X2	-0,11	0,06	-1,82	0,104	✗
X3	0,78	0,1	7,39	0,000072	✓

Source: Own source

Table 7: Post-acquisition

	Coefficient	SD	T-statistics	P-value	Significant
Constant	22,63	19,9	1,137	0,288	✗
X1	-1,82	2,7	-0,67	0,51	✗
X2	0,033	0,35	0,094	0,92	✗
X3	0,46	0,43	1,077	0,31	✗

Source: Own source

As can be seen in Table 4 of the pre-acquisition period, the most significant variable is X3 = EPS. The estimated coefficient indicates that if EPS increases by 1€, the stock price increases by 0.78€, keeping fix the ROA and ROE variables.
The effect that the other variables have on the stock price does not need to be explained because they are not significant for the share price.
As can be seen in Table 5 of the post-acquisition period, there are no significant variables, which makes sense because the general model shows a p-value of less than 0,05 and concludes that there is no relationship between ROE, ROA, EPS, and stock price. The effect of these variables does not need to be explained because they do not affect the share price.
The reason of the loss of importance of the independent variables is because in the pre-acquisition period investors were only looking for profitable companies that offered them a high return on capital (ROE), attractive returns (EPS) and an efficient company capable of turning assets into profit (ROA), however, in the last years it seems that investors were not only giving importance to these ratios, but also to the new factors to be taken into account in the banking sector.
In this study, a pre-acquisition and post-acquisition period was analyzed to prove that factors that influenced the stock price before are not the same ones that influence today. The banking sector is carrying out a digital transformation where the collaboration of new players, the Fintech, has been necessary. In the case of BBVA, the acquisition of these startups has been carried out to accelerate their transformation, so although the cost of acquisition, investment in them and maintenance has been high, it is considered a good investment for BBVA's future to guarantee a safe position for BBVA within the new digitized banking sector. Investors have realized that these acquisitions were not made to increase the bank's performance, a goal pursued by Spanish banks during the economic crisis when they were acquiring other banks, but rather they were pursuing a digital transformation strategy and future investments for BBVA. That is why, in the post-acquisition period, the performance variables no longer had the same importance as in the pre-acquisition period and we can conclude that the new variables that should affect the stock price in the post-acquisition period would be the

expectations of growth that the shareholders have after the purchases of the Fintech companies.

5.2.2.1. Analysis PER of ANOVA

H0 = There is no influence of ROE, ROA, and EPs in price to earnings ratio
H1 = There is an influence of ROE, ROA, and EPs in price to earnings ratio

To study the implication of performance variables in the price-to-earnings ratio, it has also been done through the Statistic Kingdom platform. This ratio indicates how much investors are willing to pay per dollar of earnings and a high PER could mean that investors are expecting higher growth in the future, meaning that, the more they are willing to pay the more value has to company for them. The results of the analysis indicate that before the acquisition, ROE, ROA, and EPS were important factors that affected the 95.3% of the PER ratio, however, in the post-acquisition period, those variables no longer significant for the PER ratio.

Table 8: ANOVA table 6

	Adjusted R-square	F-test	p-value	Significant
Pre-acquisition period	95,3%	38.273	0.00004312	✓
Post-acquisition period	30,6%	2,61	0.123196	✗

Source: Own source

This study considered that a variable is statistically significant when the corresponding p-value is lower than 0.05.
In the pre-acquisition period, the null hypothesis (H0) that affirms that there is no influence of ROE, ROA and EP on the PER is rejected, in other words, the PER depends on the performance indices, however, in the post-acquisition period we accept the null hypothesis (H0) which says that there is no influence of ROE, ROA and EPS on the PER, which means that the performance variables do not define the PER.
According to the result of the Adjusted R-square of the pre-acquisition study is 95,3%, which means that 95,3% of the price-to-earnings ratio can be explained by the variability ROE, ROA and EPS and the rest 4,7% is from others variables not taking into account in this study. Comparing to the post-acquisition Adjusted R-square which is 30,6%, we can see ROE, ROA and EPS no longer determinate the PER value.
By looking at the ANOVA table it can be measured the goodness of fit of the model. First of all, we compare the F-test which decreased after the acquisitions from 75.37 to 2.61, meaning that before the acquisitions ROE, ROA, and EPS were significant for the price-to-earnings ratio, however, after the acquisitions they are no longer significant. These results also match with the p-value results, which before acquisitions are was less than 0,001 and after it increased to 0,12 reaching the same conclusion as the F-test.
Looking at table 4, it can be studied if there is an excessive degree of collinearity between the independent performance variables. As can be seen in Table 4, in the post-acquisition period the variables are not highly related with a value of 1,697, but in the post-acquisition period, the variables are more correlated with a factor of 4,516.

Table 9: PER VIF

VIF	
Pre-acquisition	Post-acquisition
1.697	4.516

Source: Own source

It would also be interesting to look at the details of both models to identify which are the variables that are most relevant to determine the PER. This will help to know exactly which variables (ROE, ROE, EPS) are the most determining factor of the PER. To analyze this, the specific data of the 3 variables of the pre-acquisition and post-acquisition period have been shown in the following two tables.

Table 10: Pre-acquisition

	Coefficient	SD	T-statistics	P-value	Significant
Constant	14.421	4.52	3.18711	0.0128	✗
X1	-0.7992	0.388	-2.0594	0.0734	✗
X2	-0.1637	0.0832	-1.9670	0.0847	✗
X3	1.1708	0.1420	8.2446	0.000034	✓

Source: Own source

Table 11: Post-acquisition

	Coefficient	SD	T-statistics	P-value	Significant
Constant	12,63	22,64	0,55	0,59	✗
X1	0,89	3,08	0,29	0,77	✗
X2	-0,64	0,4	-1,57	0,15	✗
X3	1,22	0,49	2,48	0,037	✓

Source: Own source

As can be seen in Table 7 of the pre-acquisition period, the most significant variable is X3 = EPS. The estimated coefficient indicates that if EPS increases by 1€, the PER increases by 1.1708€, keeping fix the ROA and ROE variables.
The effect that the other variables have on the stock price does not need to be explained because they are not significant for the PER.
As can be seen in Table 8 of the post-acquisition period, even though the general model was not significant, it shows that the variable X3=EPS affects PER. The estimated coefficient indicates that if EPS increases by 1€, the PER increases by 1,22€, keeping fix the ROA and ROE variables, however, this increase is not relevant because the general model is not significant.
According to our regression study, in the pre-acquisition period, the dependent variable that is significant and has an effect on PER is also EPS. The positive relationship between PER and EPS is because if BBVA increases its earnings per share this may attract more investors and an increase in demand makes price goes up. In this case, if we increase 1 unit of PER, EPS increase by 1.1708.
The effect of other variables do not need to be explained because they aren't significant for the price to earnings ratio. It can be concluded that, as in the previous case of the stock price, investors are not only looking for profitable companies but also for companies that invest in long-term projects that will ensure their existence in the market for years. The fact of acquiring these Fintech means that BBVA wants to be present in the new digitized banking sector.

VI. CONCLUSIONS

6.1 Comparative analysis conclusions

The comparative analysis concludes that during the post-acquisition period all the variables studied have improved, especially those related to performance.
Thanks to the distributive innovation brought by Fintech companies to BBVA, they have allowed it to increase the performance of its assets, making them more efficient. Specifically, Madiva has helped in key projects that have added value to BBVA, creating very valuable assets related to Big data, such as Beconomy, BBVA Invest, and so on.
BBVA has also slightly improved its financial structure. This can be seen in the Debt-to-Equity ratio and non-performing loans ratio variables, which are important to analyze to verify that the purchases of Fintech companies would not have increased the bank's bad debt and therefore worsened the financial structure of the bank.
The variable of the number of ATM shows that just after the Simple and Madiva acquisitions, ATMs, a symbol of the bank's digitization, have increased exponentially. After the purchase of that two acquisitions, the BBVA started his digitalization transformation strategy more aggressively.
Finally, shareholder value variables have been taken into account because in the linear regression analysis the correlation between performance and shareholder value is studied.

6.2 Regression analysis conclusions

This study aimed to determine the effect of the increase in financial performance after the acquisitions of fintech on the shareholder value in the particular case of BBVA.

The unit period of analysis was annual because adapting that disruptive technology such as Big Data or Machine Learning can take way longer than a few months. The secondary data was collected from 2008 and 2019 and 5 out of 9 variables were selected to carry out a linear regression analysis to see the correlation between the increase of performance, seen in the comparative analysis, and the shareholder value.

The linear regression study concludes that in the pre-acquisition period the performance variables were significant to explain both the value of the stock price and the PER, but that in the post-acquisition period these variables are no longer significant. This means that other variables define the stock price and the PER in the post-acquisition period.

It has been concluded that these variables could be the future expectations of the investments that are positively affected by the Fintech acquisitions that the bank has carried out in recent years.

This means that if BBVA wants to create value for its shareholders, it must focus on its digital transformation strategy and not so much on performance ratios because these no longer define value for them.

6.3 Recommendations

As shown in the comparative study, Fintech acquisitions have led to an increase in performance, solvency, liquidity, and improved BBVA's asset structure. Therefore, it recommends that BBVA continue to work closely with these Fintech companies and improve

their service to their clients with the new Big Data or machine learning processes that, through these startups, have facilitated their digital transformation. On the other hand, as Fintech companies collaborate with a large Spanish bank they have access to financial resources easily and have more financial security since they are backed by a highly solvent bank.
Furthermore, its Fintech portfolio is quite complete, from Big Data to design, so it is recommended that BBVA optimize their value and synergies before acquiring other Fintech since now BBVA already has a team of highly qualified professionals to carry out the bank's digitization strategy.
The Fintech companies have not only allowed the creation of very valuable assets for the bank, such as BBVA Valora or Beconomy, but they also add value to the shareholders, since more valuable assets increase the value of the company and for shareholders, this is the most important thing, being part of something that increases in value over time.
As has been shown in the linear regression study, unlike the pre-acquisition period, other variables not considered in the study are the new determinants of the stock price and PER in the post-acquisition period and it is estimated that those new variables that influence the shareholder value of the period after the acquisitions are the expectations of the future by the shareholders and growth expectations due to the incorporation of advanced technological processes that facilitate operations to the bank and improve the customer experience.
It is recommended that BBVA managers not only pay attention to performance ratios as they have lost their relevance during the post-acquisition period for investors but also other factors such as future expectations and long-term growth which may be considered more relevant for investors.

It is important also to highlight the new regulations that legal institutions are making for Fintech companies. The European or Spanish central bank has already realized the disruptive potential of these Fintech companies in the industry and they are working on their regulation. So once these are implemented, Fintech companies may lose the flexibility and freedom that they offer to their clients since those regulations may be even more restrictive than the ones for traditional banks due to the extensive use of data and technological processes. It is recommended to regulate these Fintech companies but to a certain extent, so that they do not lose their added value and that they simply become one more digital bank because if the legal institutions regulate these Fintechs too much they can delay their process of innovation that in the end benefits everyone, both consumers and the banks, since banks incorporate startup innovations into their value chain without the need to invest in R&D and consumers have access to better customer services thanks to technology.

It is interesting to mention in this point that due to the current situation with COVID-19, the use of cash has fallen due to the economic slowdown of the confinement and the recommendation to encourage card payments to prevent contagion, a situation that has favored online payment operations and Fintech companies.

The specific case of PayPal is worth mentioning. During the last months, PayPal stopped being just a tool to send and receive money or process online payments and started getting involved with credit service for both individuals and companies.

According to Forbes, this application has been granting loans to more than 300,000 small businesses since 2013, issuing more than 15 billion in the form of advances, making PayPal starting acting as a bank.

Even the United States government approved PayPal to be one of the companies through which Americans could apply for pandemic aid and low-interest loans. A gesture that puts this Fintech on the same level as traditional banks.

6.4 Limitations and further study

The results of the comparative study reinforce the correlation previously found in previous studies on the influence of the fintech sector on the financial performance of the banking sector. In the linear regression study, it has been concluded that there are other variables that impact shareholder value in the post-acquisition period, and it is intuited that future and growth expectations are the new determinants for shareholder value.
So it would be interesting to do a linear regression analysis with these variables of future expectations and growth to see if these are the variables that define the shareholder value and not others.

There have been limitations in this study for obtaining fintech financial data, so an investigation with the specific data of each Fintech that BBVA acquired would help to reinforce this study. As these Fintech are small and private, their financial data are not available to the public, unlike BBVA's annual accounts, which are available to everyone.
With the help of these data, for example, a specific analysis could be made to find out which Fintech has contributed the most to the bank or to estimate to determine the average time it takes for a large bank to adopt the innovations and technologies of financial startups.

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VII. APPENDIX

1. Stock price regressions data:

1.1 Pre-acquisition period:

1.1.1 Hypothesis

H0 = There is no influence of ROE, ROA, and EPs in stock price
H1 = There is an influence of ROE, ROA, and EPs in stock price

1.1.2 Regression Model

Groups	X1	X2	X3	Y
Data	21,5 16 15,8 8 4 7,1	1,04 0,85 0,89 0,61 0,37 0,64	1,31 1,08 1,17 0,62 0,32 0,56	12,29 18,04 10,17 8,57 9,42 12,39
P-value	**0.763851**	**0.104958**	**0.0000769147**	0.0157252
S	6.502136	36.505189	22.725470	16.604809
Skewness	0.657276	0.748768	1.131249	1.113981
Normality	0.5253	0.003000	0.005450	0.04936

The program estimated this system:
Y = 10.337563 + 0.0902483 X1 - 0.113818 X2 + 0.785120 X3
with the value of R Square= 0.9, the Adj R Sqr= 0.863, the homoscedasticity= 0.04 and the VIF= 1.697

1.1.3 Correlation matrix

	Y	X1	X2	X3
Y	1.00000	-0.328061	0.330682	0.926532
X1	-0.328061	1.00000	0.0140832	-0.337434
X2	0.330682	0.0140832	1.00000	0.540121
X3	0.926532	-0.337434	0.540121	1.00000

1.1.4 ANOVA table

Source	df	Sum of Square*	Mean Square**	F statistic	P-value
Regression (between ŷi and yi)	3	2730.694203	910.231401		
Residual (between yi and ŷi)	8	302.222464	37.777808	**24.0943**	**0.000232761**
Total (between yi and yi)	11	3032.916667	275.719697		

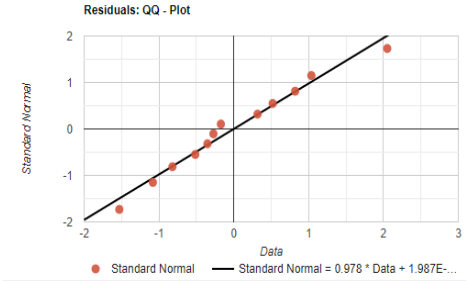
*Represents the difference between the predicted value (by the regression) and y average
**Represent the difference between the dependent value(y) and the predicted value(by the regression)
F Statistic: The bigger F is, the higher the chance that the regression is significant
P-value: The smaller p-value is, the higher the chance that the regression is significant
As P-value is less than 0,05, we reject H0, so there is an influence between stock price and performance ratios.

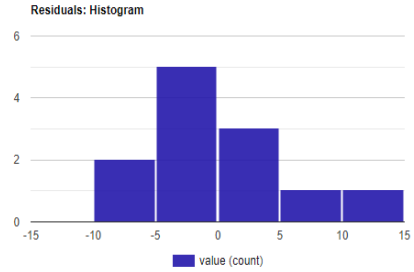
	Coeff	SE	t-stat	lower t	upper t	Stand Coeff	p-value	VIF
b	10.33	3.3849	3.0540	2.5319	18.143	0.0000	0.0157	
X1	0.0902	0.2903	0.3108	-0.5792	0.7597	0.0353	**0.7638**	1.2023
X2	-0.1138	0.0622	-1.8280	-0.2573	0.0297	-0.2502	**0.1049**	1.5042
X3	0.7851	0.1062	7.3901	0.5401	1.0301	1.0745	**0.00003**	1.6972

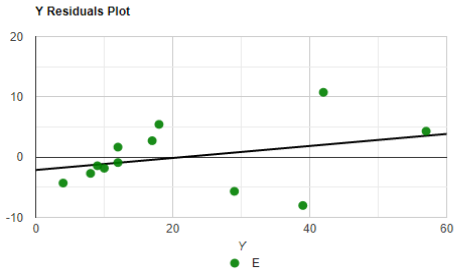
1.1.5 Relationship and Goodness of fit
About the Y and X relationship:
R square (R2) equals 0.900353. It means that the predictors (Xi) explain 90.0% of the variance of Y.
The adjusted R square equals 0.862985.
The coefficient of multiple correlations (R) equals 0.948869. It means that there is a very strong direct relationship between the predicted data (ŷ) and the observed data (y).

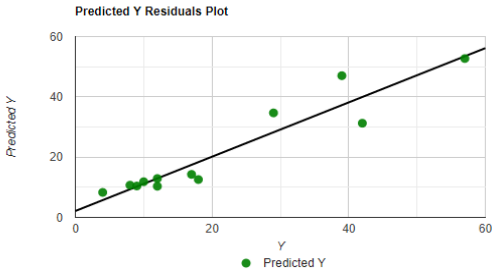
About the Goodness of fit of the model:
Overall regression: right-tailed, F(1,8) = 24.094341, p-value = 0.000232761. Since p-value < α (0.05), we reject the H0.

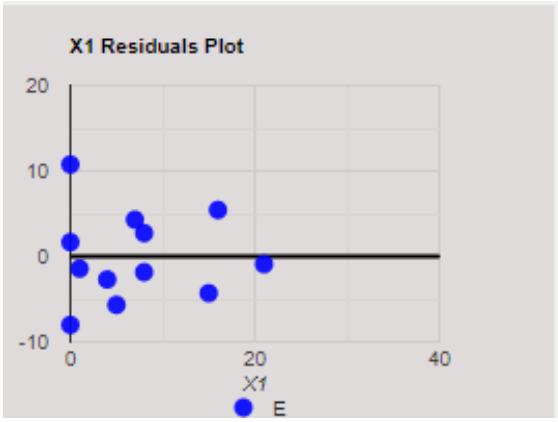
1.1.6 Graphics

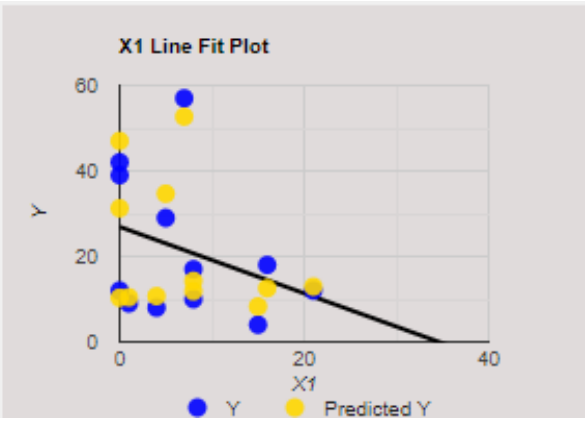


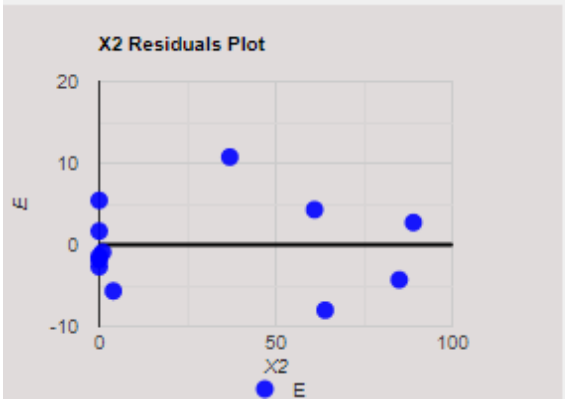


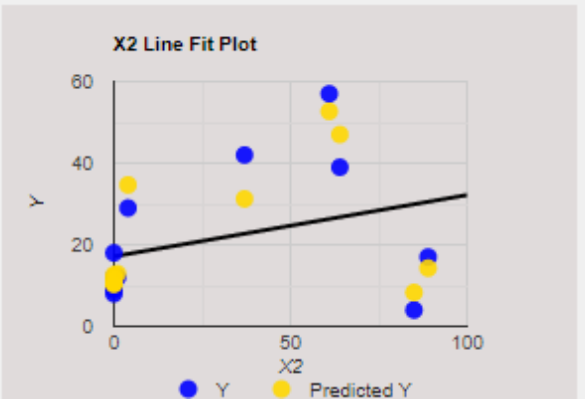


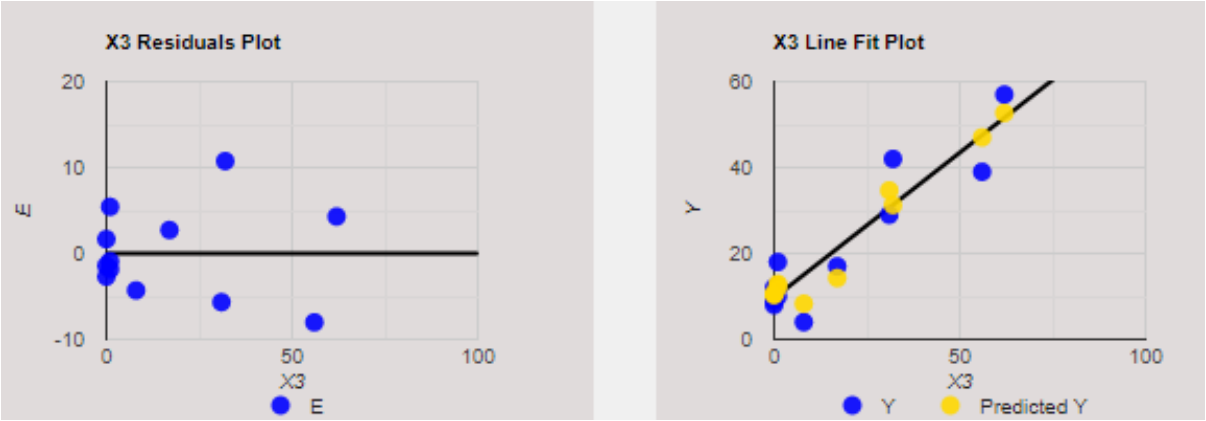












1.2 Post-acquisition period:

1.2.1 Hypothesis

H0 = There is no influence of ROE, ROA, and EPs in stock price
H1 = There is an influence of ROE, ROA, and EPs in stock price

1.2.2 Regression Model

Groups	X1	X2	X3	Y
Data	5,6 5,3 7,3 7,4 11,6 9,9	0,5 0,46 0,64 0,68 0,91 0,82	0,44 0,6 0,49 0,48 0,76 0,66	9,39 7,33 6,77 8,5 5,29 5,58
P-value	**0.518417**	**0.927284**	**0.312656**	0.288395
S	2.490893	37.300581	29.922501	24.250430
Skewness	0.463226	0.638057	0.655193	1.261700
Normality	0.6298	0.003115	0.004032	0.006736

The program estimated this system:
Y = 22.638426 - 1.829432 X1 + 0.0337694 X2 + 0.465482 X3
with the value of R Square= 0.461, the Adj R Sqr= 0.259 the homoscedasticity= 0.104 and the VIF= 4.516

1.2.3 Correlation matrix

	Y	X1	X2	X3
Y	1.00000	-0.298364	0.606995	0.650414

X1	-0.298364	1.00000	-0.302340	-0.164965
X2	0.606995	-0.302340	1.00000	0.867475
X3	0.650414	-0.164965	0.8674	1.00000

1.2.4 ANOVA table

Source	df	Sum of Square	Mean Square	F statistic	p-value
Regression (between ŷi and yi)	3	2983.231497	994.410499	**2.282273**	**0.156039**
Residual (between yi and ŷi)	8	3485.685169	435.710646		
Total (between yi and yi)	11	6468.916667	588.083333		

	Coeff	SE	t-stat	lower	upper t	Stand Coeff	p-value	VIF
b	22.638	19.908	1.1371	-23.270	68.547	0.0000	0.2883	
X1	-1.8294	2.7083	-0.6754	-8.0749	4.4160	-0.1879	**0.5184**	1.1489
X2	0.0337	0.3585	0.0941	-0.7931	0.8606	0.0519	**0.9272**	4.5162
X3	0.4654	0.4319	1.0775	-0.5306	1.4616	0.5743	**0.3126**	4.2182

1.2.5 Relationship and Goodness of fit

About the Y and X relationship:

R square (R2) equals 0.461164. It means that the predictors (Xi) explain 46.1% of the variance of Y.

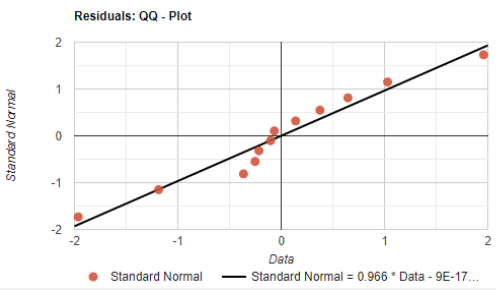
Adjusted R square equals 0.259101.

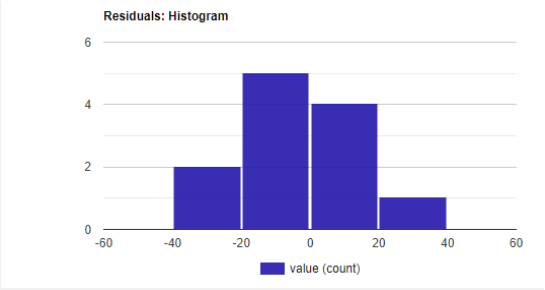
The coefficient of multiple correlation (R) equals 0.679091. It means that there is a strong direct relationship between the predicted data (ŷ) and the observed data (y).

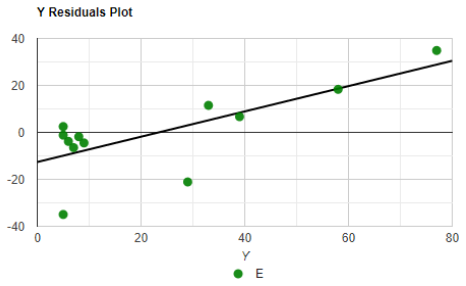
About the Goodness of fit of the model:

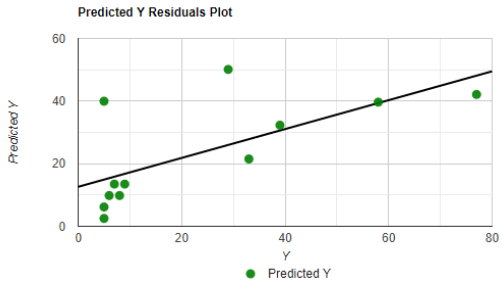
Overall regression: right-tailed, $F(1,8) = 2.282273$, p-value = 0.156039. Since p-value $\geq \alpha$ (0.05), we accept the H0.

1.2.6 Graphics

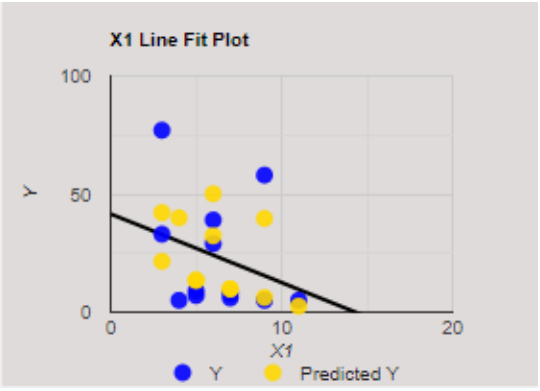

Residuals: QQ - Plot
Standard Normal
Data
Standard Normal
Standard Normal = 0.966 * Data - 9E-17...

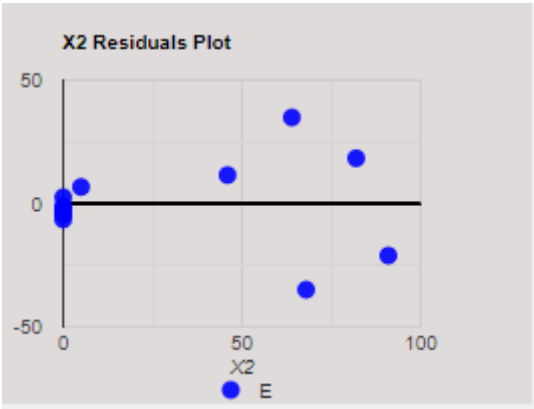

Residuals: Histogram
value (count)

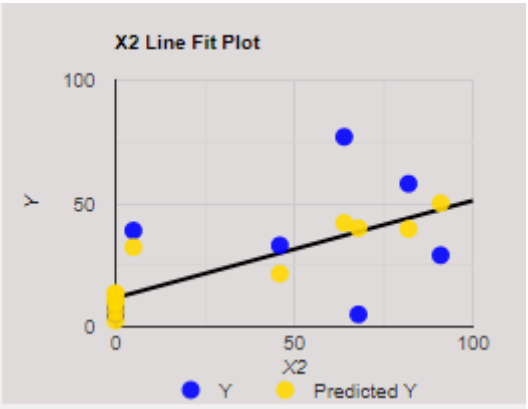

Y Residuals Plot
Y
E

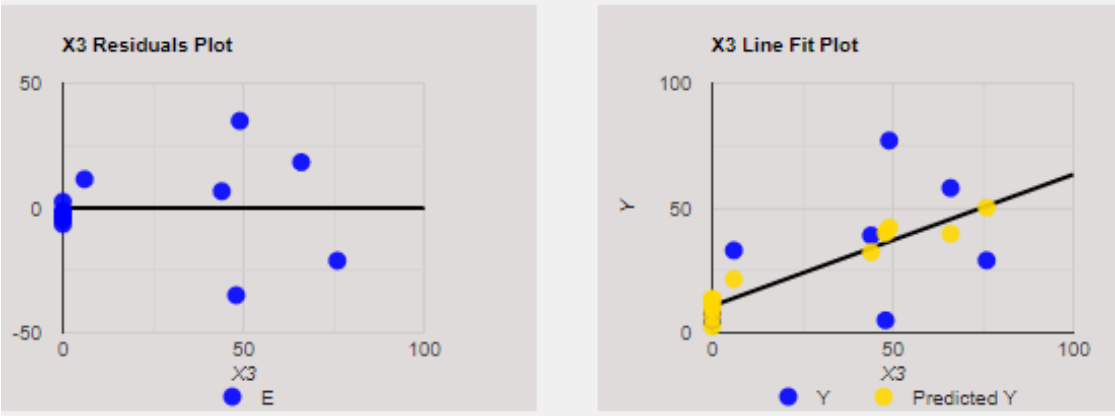

Predicted Y Residuals Plot
Predicted Y
Y
Predicted Y


X1 Residuals Plot
X1
E


X1 Line Fit Plot
Y
X1
Y
Predicted Y


X2 Residuals Plot
X2
E


X2 Line Fit Plot
Y
X2
Y
Predicted Y



2.PER regressions data:

2.1 Pre-acquisition period:

2.1.1 Hypothesis

H0 = There is no influence of ROE, ROA, and EPs in stock price
H1 = There is an influence of ROE, ROA, and EPs in stock price

2.1.2 Regression Model

Groups	X1	X2	X3	Y
Data	21,5 16 15,8 8 4 7,1	1,04 0,85 0,89 0,61 0,37 0,64	1,31 1,08 1,17 0,62 0,32 0,56	3,34 7,2 4,3 6,69 16,57 18,75
P-value	**0.0734216**	**0.0847286**	**0.0000351319**	0.0128591
S	6.502136	36.505189	22.725470	27.454094
Skewness	0.657276	0.748768	1.131249	1.052440
Normality	0.5253	0.003000	0.005450	0.006513

The program estimated this system:
Y = 14.421090 - 0.799237 X1 - 0.163720 X2 + 1.170863 X3
with the value of R Square= 0.935, the Adj R Sqr= 0.91 the homoscedasticity= 0.298 and the VIF=1.697

2.1.3 Correlation matrix

	Y	X1	X2	X3
Y	1.00000	-0.533872	0.302919	0.920373
X1	-0.533872	1.00000	0.0140832	-0.337434
X2	0.302919	0.0140832	1.00000	0.540121
X3	0.920373	-0.337434	0.540121	1.00000

2.1.4 ANOVA table

Source	df	Sum of Square	Mean Square	F statistic	p-value
Regression (between ŷi and yi)	3	7750.956006	2583.652002	**38.273208**	**0.000043128**
Residual (between yi and ŷi)	8	540.043994	67.505499		
Total (between yi and yi)	11	8291.00	753.727273		

	Coeff	SE	t-stat	lower	upper t	Stand Coeff	p-value	VIF
b	14.421	4.5248	3.18711	3.9868	24.855	0.0000	0.0128	
X1	-0.7992	0.3880	-2.0594	-1.6941	0.0956	-0.1892	**0.0734**	1.2023
X2	-0.1637	0.0832	-1.9670	-0.3556	0.0282	-0.2176	**0.0847**	1.5042
X3	1.1708	0.1420	8.2446	0.8433	1.4983	0.9691	**0.0000**	1.6972

2.1.5 Relationship and Goodness of fit

About the Y and X relationship:

R square (R2) equals 0.934864. It means that the predictors (Xi) explain 93.5% of the variance of Y.

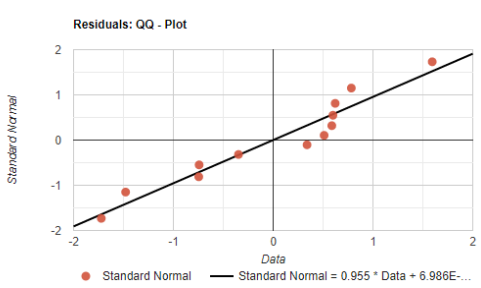
Adjusted R square equals 0.910438.

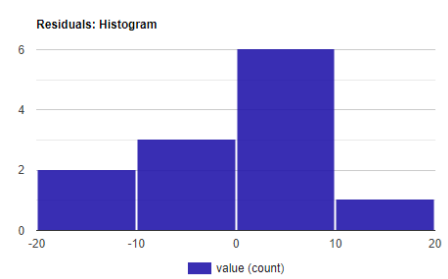
The coefficient of multiple correlation (R) equals 0.966884. It means that there is a very strong direct relationship between the predicted data (ŷ) and the observed data (y).

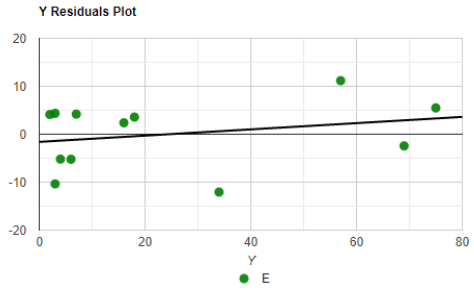
About the Goodness of fit of the model:

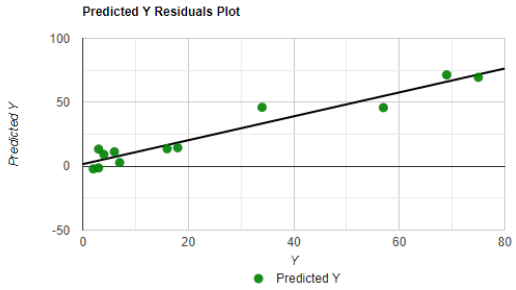
Overall regression: right-tailed, F(1,8) = 38.273208, p-value = 0.0000431283. Since p-value < α (0.05), we reject the H0.

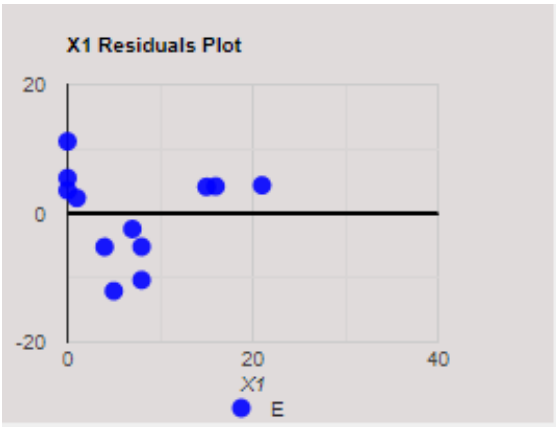
2.2.6 Graphics

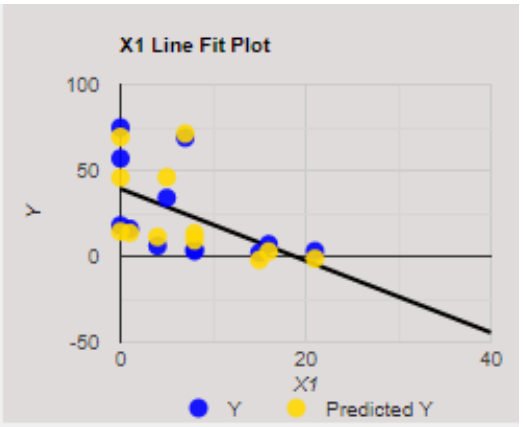


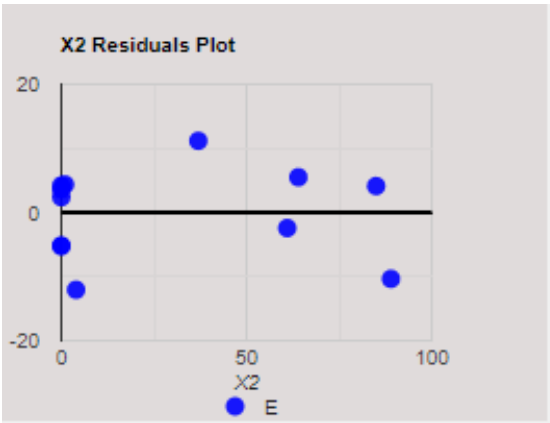


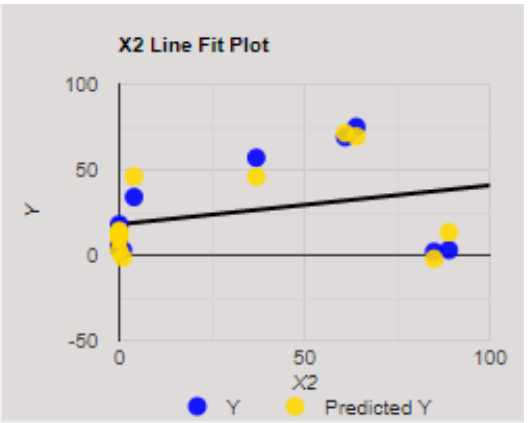


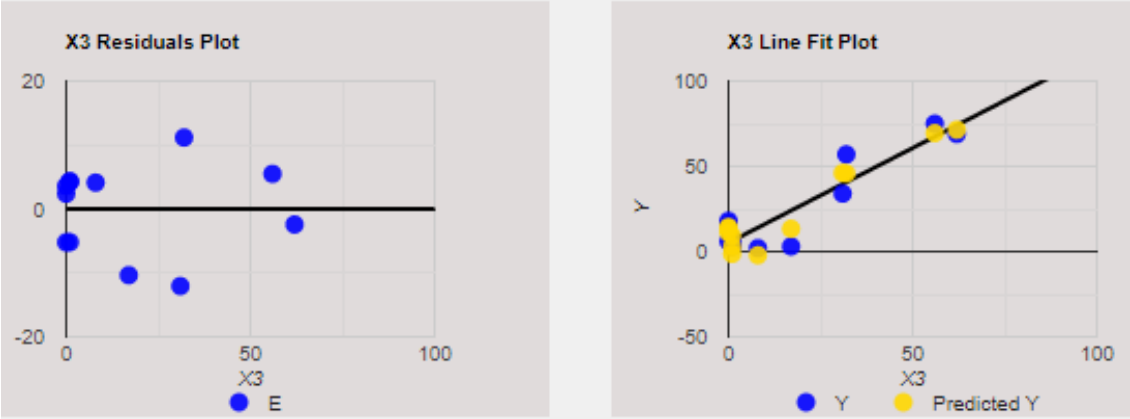












2.2 Post-acquisition period:

2.2.1 Hypothesis

H0 = There is no influence of ROE, ROA, and EPs in stock price
H1 = There is an influence of ROE, ROA, and EPs in stock price

2.2.2 Regression Model

Groups	X1	X2	X3	Y
Data	5,6 5,3 7,3 7,4 11,6 9,9	0,5 0,46 0,64 0,68 0,91 0,82	0,44 0,6 0,49 0,48 0,76 0,66	13,95 14,32 10,01 23,18 12,43 10,73
P-value	**0.777980**	**0.154997**	**0.0377696**	0.591977
S	2.490893	37.300581	29.922501	28.490296
Skewness	0.463226	0.638057	0.655193	1.579269
Normality	0.6298	0.003115	0.004032	0.008730

The program estimated this system:
Y = 12.638198 + 0.898272 X1 - 0.640324 X2 + 1.221199 X3
with the value of R Square= 0.495, the Adj R Sqr= 0.306 the homoscedasticity= 0.696 and the VIF=4.516

2.2.3 Correlation matrix

	Y	X1	X2	X3
Y	1.00000	0.120416	0.250533	0.542397

X1	0.120416	1.00000	-0.302340	-0.164965
X2	0.250533	-0.302340	1.00000	0.867475
X3	0.542397	-0.164965	0.867475	1.00000

2.2.4 ANOVA table

Source	df	Sum of Square	Mean Square	F statistic	p-value
Regression (between ŷi and yi)	3	4420.56791	1473.522	**2.6148**	**0.123196**
Residual (between yi and ŷi)	8	4508.098755	563.51234		
Total (between yi and yi)	11	8928.666667	811.69697		

	Coeff	SE	t-stat	lower	upper t	Stand Coeff	p-value	VIF
b	12.638	22.640	0.5582	-39.571	64.847	0.0000	0.5919	
X1	0.8982	3.0800	0.2916	-6.2043	8.0008	0.0785	**0.7779**	1.1489
X2	-0.6403	0.4077	-1.5702	-1.5806	0.3000	-0.8383	**0.1549**	4.5162
X3	1.22119	0.4912	2.4857	0.0883	2.3540	1.2825	**0.0377**	4.2182

2.2.5 Relationship and Goodness of fit

About the Y and X relationship:

R square (R2) equals 0.495098. It means that the predictors (Xi) explain 49.5% of the variance of Y.

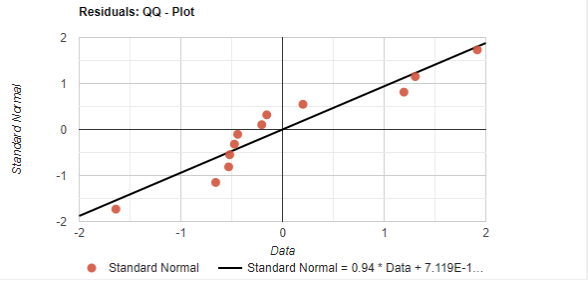
Adjusted R square equals 0.305760.

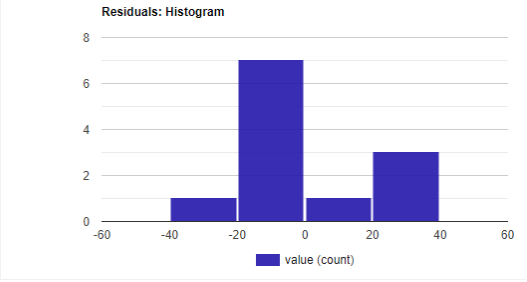
The coefficient of multiple correlation (R) equals 0.703632. It means that there is a strong direct relationship between the predicted data (ŷ) and the observed data (y).

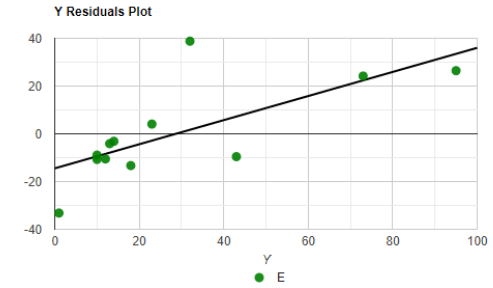
About the Goodness of fit of the model:

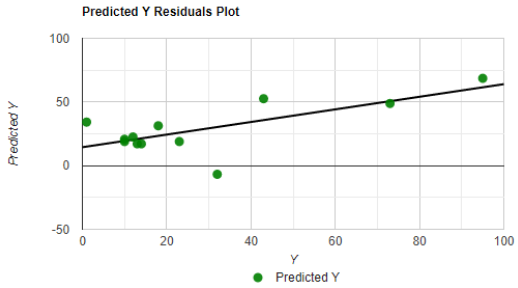
Overall regression: right-tailed, $F(1,8) = 2.614890$, p-value = 0.123196. Since p-value $\geq \alpha$ (0.05), we accept the H0.

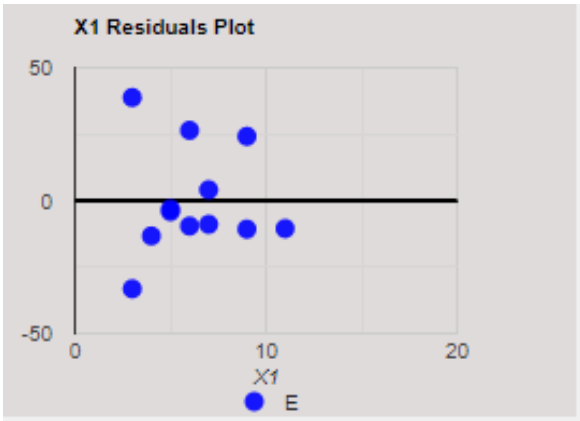
2.2.6 Graphics

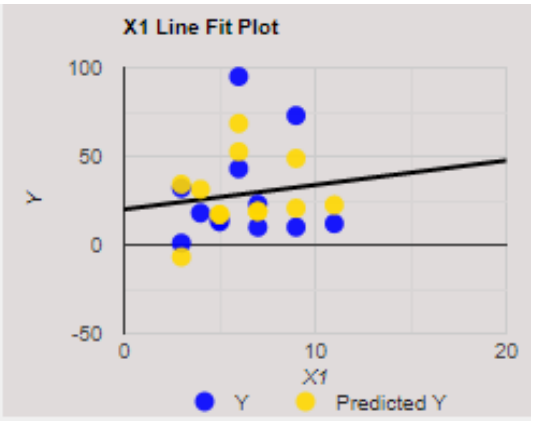

Residuals: QQ - Plot
Standard Normal
Data
Standard Normal
Standard Normal = 0.94 * Data + 7.119E-1...

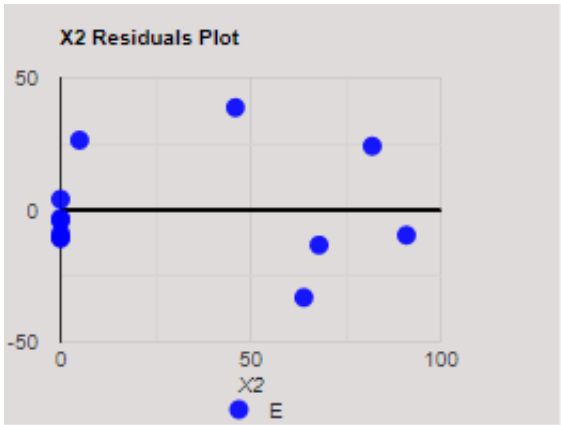

Residuals: Histogram
value (count)

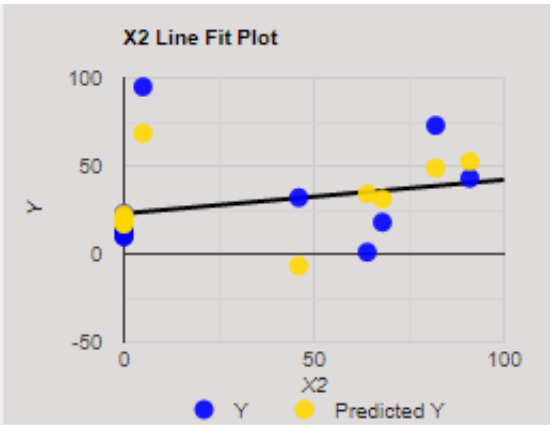

Y Residuals Plot
Y
E

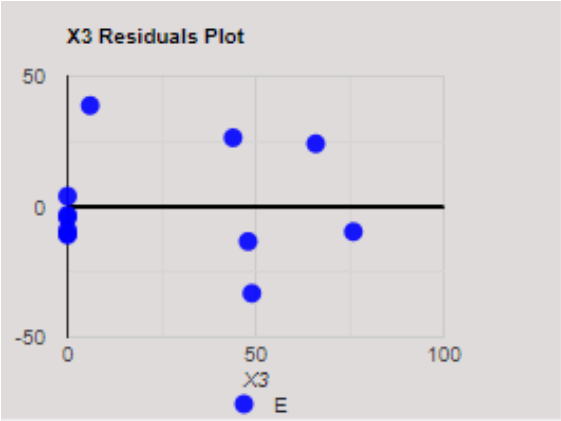

Predicted Y Residuals Plot
Predicted Y
Y
Predicted Y

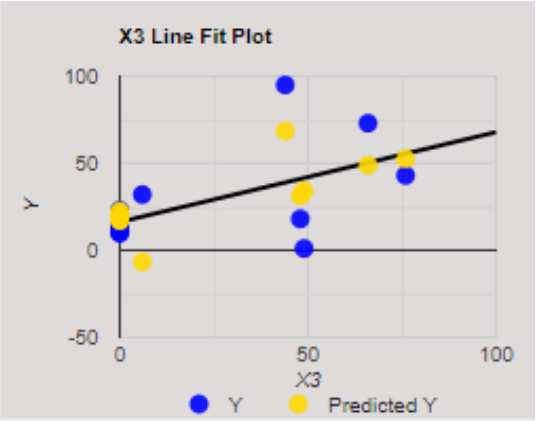

X1 Residuals Plot
X1
E


X1 Line Fit Plot
Y
X1
Y
Predicted Y


X2 Residuals Plot
X2
E


X2 Line Fit Plot
Y
X2
Y
Predicted Y


X3 Residuals Plot
50
0
-50
0
50
100
X3
E


X3 Line Fit Plot
100
50
0
-50
Y
0
50
100
X3
Y
Predicted Y